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A Consolidation of Engineering and Mining Journal and Mining and Scientific Press

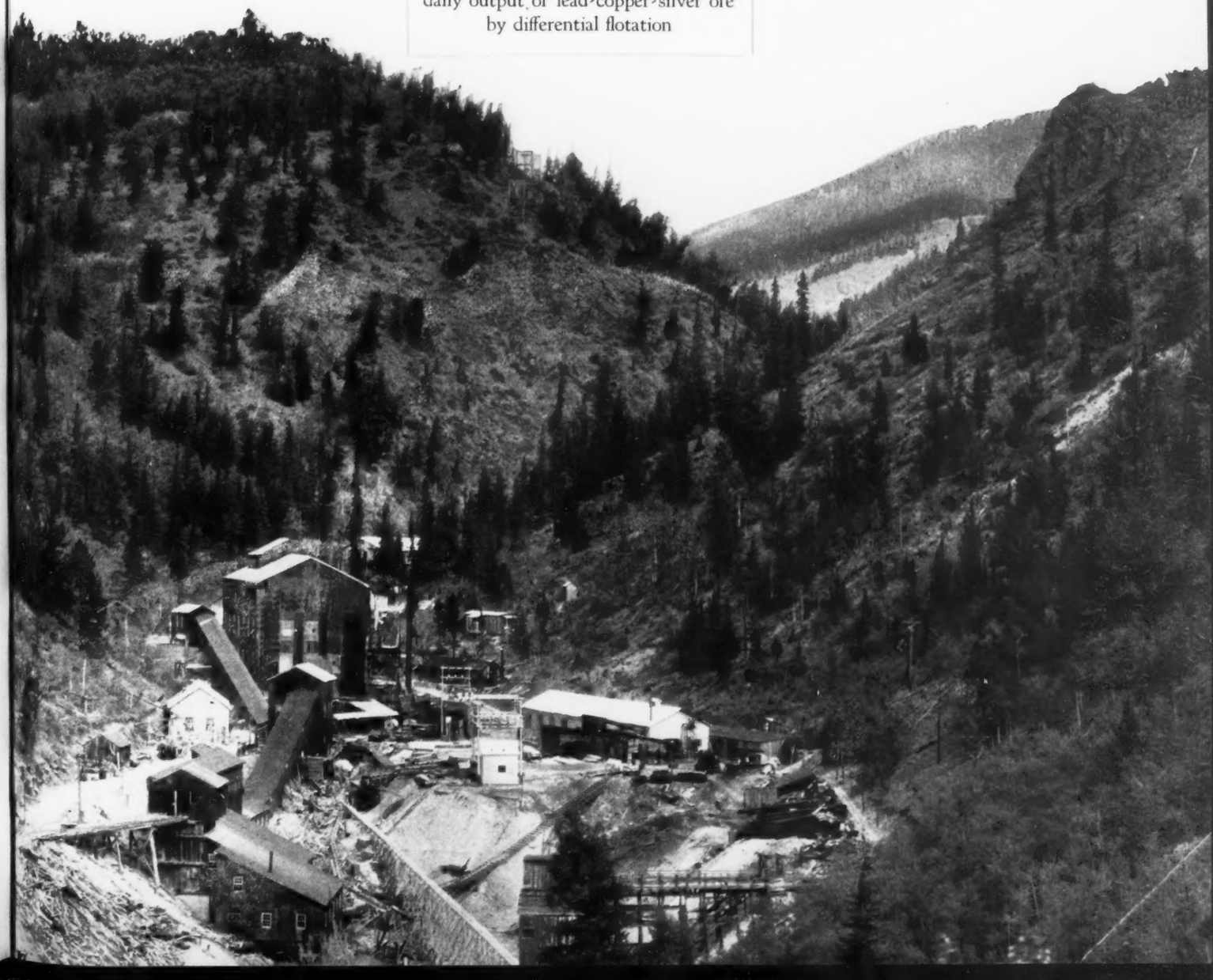
METAL AND NON-METALLIC MINING · MILLING · SMELTING · REFINING · MARKETING

THE ELECTRIC POWER SHOVEL - - - - BY R. W. McNEILL

ORE POSSIBILITIES AT THE CONGRESS MINE - BY W. F. STAUNTON

AMERICAN PROSPERITY—*A Study of Its Causes* - BY ARTHUR NOTMAN

SURFACE PLANT of the Rawley Mines, Inc., at Bonanza, Colorado Here a 275-ton mill is treating the daily output of lead-copper-silver ore by differential flotation



New Cornelia Copper Co.
Ajo, Arizona
H. KENYON BURCH, *Cons. Eng.*

Equipment in the New Cornelia Concentrating Mill, at Ajo, Ariz., and Accessory Operations

Equipment	Trade Name or Type	Manufacturer and Address
Steam shovels	Osgood Model 105	Osgood Co., Marion, Ohio
Standard-gage ore cars	20-yd. automatic air side-dump cars.	
Pan conveyors		Case Crane & Engineering Co., Kilbourne & Jacobs Division, Columbus, Ohio
Gyratory crushers	McCully	Worthington Pump & Machinery Corporation, Cudahy, Wis.
	Gates Style K	Stephens-Adamson Manufacturing Co., Aurora, Ill.
Motors and electrical equipment		Allis-Chalmers Manufacturing Co., Milwaukee
Conveyors	Ball-bearing	Stephens-Adamson Manufacturing Co., Aurora, Ill.
Rolls		
Ring grizzlies	Burch	
Weightometers		Stephens-Adamson Manufacturing Co., Aurora, Ill.
Rod mills	Marcy	
Classifiers	Dorr	Queen City Foundry Co., Denver, Colo.
Tables	Plat-O	The Dorr Co., Denver, Colo.
Thickeners	Dorr	Deister Machine Co., Fort Wayne, Ind.
Vacuum filters	Drum	The Dorr Co., Denver, Colo.
Vacuum pumps		Oliver Continuous Filter Co., San Francisco, Calif.
Compressors		Ingersoll-Rand Co., El Paso, Tex.
Blowers	Turbo	Ingersoll-Rand Co., El Paso, Tex.
Magnetic clutches		De Laval Steam Turbine Co., Trenton, N. J.
Centrifugal pumps		Cutler-Hammer Manufacturing Co., Milwaukee
Wood stave pipe		De Laval Steam Turbine Co., Trenton, N. J.
Plunger pumps		Pacific Tank & Pipe Co., Los Angeles
Dayton couplings		Worthington Pump & Machinery Corporation, Cudahy, Wis.
V-notch meter	4,000 g.p.m. Yarway-Lea	Youngstown Sheet & Tube Co., Youngstown, Ohio
Cranes		Yarnall-Waring Co., Philadelphia
Conveyor belts		Pawling & Harnischfeger Co., Milwaukee
		Goodyear Tire & Rubber Co., Akron, Ohio
		Goodrich Rubber Co., Akron, Ohio
		New York Belting & Packing Co., New York
		Manhattan Rubber Manufacturing Co., Passaic, N. J.

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PRACTICALLY from the time the ore is first received from the steam shovels, at this New Cornelia Copper Co. plant at Ajo, Arizona, it is handled by conveying equipment built by Stephens-Adamson Mfg. Co.

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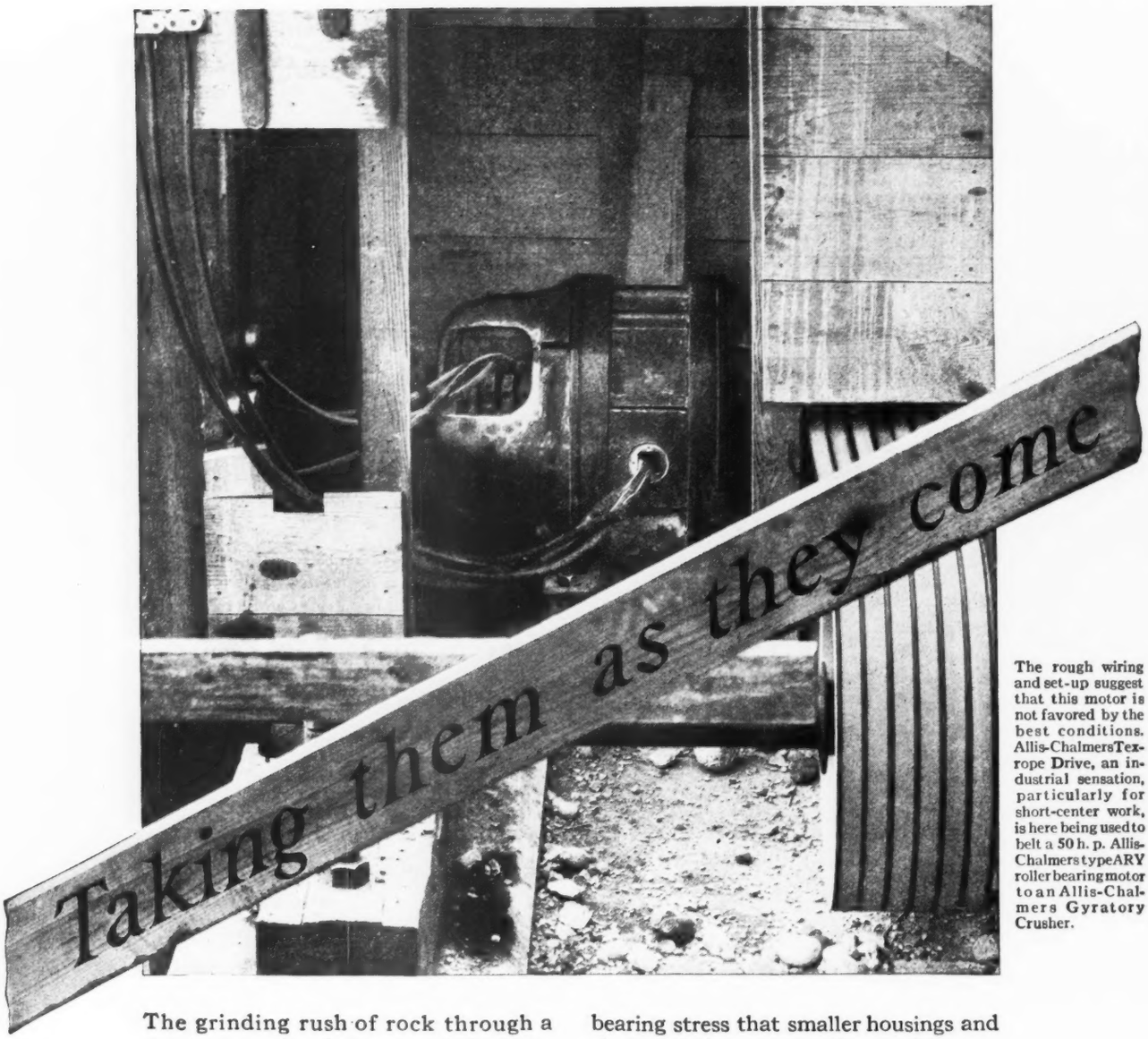

The rough wiring and set-up suggest that this motor is not favored by the best conditions. Allis-Chalmers Texrope Drive, an industrial sensation, particularly for short-center work, is here being used to belt a 50 h. p. Allis-Chalmers type ARY roller bearing motor to an Allis-Chalmers Gyratory Crusher.

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ENGINEERING AND
MINING JOURNAL

JOSIAH EDWARD SPURR, Editor

Volume 122 **New York, November 13, 1926** *Number* 20

Copper Exporters, Inc.

ALTHOUGH it is too early to attempt any analysis of the effects of the operation of Copper Exporters, Inc., the course of the domestic market since the association commenced to function is interesting. Prior to the official announcement on Oct. 11 that the necessary papers had been filed with the Federal Trade Commission at Washington, copper was selling at about 14.025c., delivered. During the ensuing week prices advanced to about 14.175 with very moderate buying, and since that time a steady decline has carried the price to 13.925c. The brief temporary spurt was the consequence of a sharp advance in London, where dealers and speculators had about concluded, after repeated false alarms, that the formation of any export organization had been indefinitely postponed, if not abandoned. Doubtless the psychological effect on some domestic buyers was to buy immediately against the possibility of rapid advance. Most of them, however, sat tight, and after a brief flurry the market settled down. Since then it has been dull and weak.

In the meantime the "official" price for export business was maintained at 14.40c. c.i.f. for three weeks, after which it was reduced to 14.25c. Foreign sales have, on the whole, been satisfactory. Some London interests are said to have been disappointed that the export price was not pegged at a higher level. They had calculated on underselling the association by a few points and had hoped to reap a larger profit. Those guiding Copper Exporters apparently acted wisely in not naming an export price far out of line with the domestic market.

Incidentally it is understood that any member of the association who desires to sell at a level below the fixed price may do so by giving twenty-four hours' notice, and specifying the price and tonnage that he wishes to sell. When this amount has been disposed of the fixed price again comes into operation. No attempt, either directly or indirectly, has been made to allocate the foreign business among the various selling interests. But if any price cutting is to be done it must be done only after due notice to members of the association.

The statement of the Federal Trade Commission regarding the functioning of Copper Exporters under the Webb-Pomerene Act very definitely warns against "any agreement, understanding, conspiracy or act which shall enhance or depress prices or substantially lessen competition within the United States, or otherwise restrain trade therein." It is difficult to see how the producers can do any of these things unless they "conspire" to curtail production; and that they have never shown any evidence of doing. That the domestic and foreign markets can be, and in fact are, distinct and independent, seems obvious just as in the instance of sulphur and phosphate. If there is any significance in the gradual decline of the domestic price subsequent to the launching of the association and the pegging of the foreign price, it is to substantiate the contention that the two markets are entirely separate.

Three Iron-Country Accidents

TWICE WITHIN TWO AND A HALF YEARS a mine of the Lake Superior iron country has been flooded by surface waters breaking into the workings. Each accident has been attended with considerable loss of life. The first of these was the Milford disaster, on the Cuyuna range, in February, 1924. The other happened only the other day when a large area of the surface caved at the Barnes Hecker mine, on the Marquette range. Since the nature of these two accidents is broadly similar, although in details there may prove to be considerable difference, a close inspection of iron-country mining practice elsewhere where corresponding surface conditions exist is quite in order. Following the Milford occurrence a state board of investigation was appointed and duly made its report. No doubt in the present instance there will be another official investigation. But post-mortem investigations are very much like locking the stable after the horse is loose, and often their findings come when the accident has largely been forgotten, save by those who suffer from it.

At the Barnes Hecker the distance from the surface to the nearest working is reported to be 450 ft., a distance much greater than in the Milford case. A surface area of ten acres is said to be affected by the cave. Evidently here there was no chance breaking in of surface waters, but a collapse of the roof through inadequate support—a matter that goes back to the mining methods used. Closer study of ground subsidence and support of workings is urged. The loss of life in both instances emphasizes the fact that ground does not always wait to fall until after the shooting when the men have gone off shift. Sometimes it catches them at work.

Another recent iron-country accident that attracted wide attention was that in the G Pabst shaft on the Gogebic range on Sept. 24. Here the shaft wall caved below the second level, blocking the incline between this level and the eighth and bottling up the shift. In this case luck was with the miners, and after five days of strenuous effort and trapped workmen were released. Admirable co-operation between the company and its neighbors contributed largely to this fortunate result: frequent conferences of the managers as to the course to be pursued were held, and the best men in the district were drafted to take charge of the rescue work so that it might be pushed with maximum speed. It is hoped that in the thrill and reaction of the rescue any lesson that this accident may have had did not go unnoticed.

Accidents do happen that are unavoidable. But it is rarely that occurrences of the sort described take place

without giving some warning of their imminence. Fear of losing tonnage or press of other work often causes the deferring of repairs, or delays the picking down of loose ground, or the proper catching up of the back where it looks unsafe. Good engineering and careful supervision must go hand in hand with the safety campaigns intended for the men.

The Reductio ad Absurdum

THE FACTS of ore deposition will continue to be of engrossing interest to mining men, until they are settled. Fissure veins are doubtless partly due to replacement, partly to the filling of open spaces. In some cases the former of these processes of deposition is predominant; in other places, the latter. There is probably no one who doubts the importance of replacement as an agency; but there are many who doubt the filling of open spaces. One evidence of this infilling is the presence of sharp included fragments of wall rock, often isolated one from another; in many instances these indicate a condition of the vein filling, at the time of their coming to occupy their present place, such that the fragments were supported until the solution finally hardened—a thick or gelatinous condition of the containing matrix.

This evidence has been challenged; the crystalline matrix of such fissure veins has been regarded as due to replacement, and the angular inclusions as unreplaced residua. In many cases the structure of the fragments —stratification or other structure—is diversely oriented among the wall fragments and as compared to that of the wall rock; an indication, apparently, that the angular fragments are really inclusions and not residua of replacement. "Not so," say the advocates of replacement as a sufficient explanation—"the angular fragments are, to be sure, broken fragments which have been moved about, but in a fine fault-gouge which has been preferentially replaced, leaving the fragments inclosed in vein material."

The specific local data, in given cases, to be sure, exclude this theory; but for those who are theorizing, remote from the case in hand, this explanation appears sufficient. Even in the case of angular inclusions in veins which have grown by successive precipitation from solution this theory is offered, and *Engineering and Mining Journal* has published recently letters supporting this—published without editorial comment, although again in the cases described the specific data exclude this process. Nevertheless, the advocates of exclusive replacement remain unconvinced.

Finally, we have cases like those of the calcite fissure veins in limestone—like those in the Kentucky-Illinois fluorspar district described in our issues of Oct. 30 and Nov. 6, where wide veins of coarsely crystalline calcite occur in ordinary dense dark limestone, with sharp walls, and containing many isolated sharply angular fragments of the walls. All who see them acknowledge that these fragments are isolated and not mutually supporting. Since the limestone is calcium carbonate, and the spar veins are of the same material, the latter could not have originated by replacement of the former. Here we have, indeed, a reductio ad absurdum of the universal replacement theory. Yet the ingenuity of the supporters of this theory is great. It is difficult to see how their convictions can withstand this reductio; yet convictions are stubborn things. "Faith," it has been said, "is believing what you know ain't so."

Carbide Versus Electric Lamps

STRANGE WORDS regarding carbide lamps uttered at the recent Safety Congress in Detroit are hard to understand. In advocating the permissible electric cap lamp for coal mines Daniel Harrington said a few things about their use in metal mines. He is reported to have stated: "The open carbide lamp is one of the greatest hazards as to fires in metal mines, and users of this lamp have been asphyxiated by gases in both coal and metal mines. . . . While our metal miners turn a deaf ear to even the slightest hint that the electric cap lamp should be used in metal mines the fact of the matter is that the up-to-date permissible electric cap lamp gives a better light, a cheaper light, and by far a safer and more efficient light than the open, hand acetylene lamps to which the metal-mining fraternity clings so religiously and tenaciously. . . . It is my opinion that all mines, coal and metal, should be required by law to use permissible electric lamps exclusively for miners' light."

Surely this is a surprising statement. One is immediately led to ask to what extent the open carbide lamp has played a part in the asphyxiation of miners by gases in metal mines. It is difficult to picture a miner asphyxiated by the gas from his own lamp, and if the asphyxiating gases are supposed to come from the workings, to what extent are such gases found in metal mines?

The metal-mining fraternity—meaning the miners—can hardly be said to cling tenaciously and religiously to the carbide lamp. They may cling, but their grip is neither tenacious nor religious. Fifteen years ago the carbide lamp was used by few besides the engineers and bosses. Then it was candles or sunshine lamps to which the miners clung. Their grip on these relaxed as they came to realize that the carbide lamp was really better, and in turn the carbide lamp will be dropped by them for the electric lamp whenever it can be shown that the latter is really better.

Electric light is superior to any other on several counts. But the electric cap lamp is something else, and the miner at the moment is apt to have a thing or two against it. First it has glass and filament to smash if one comes too suddenly against the back—it can't be treated "rough." Unlike the carbide lamp it can't be dropped, without its breaking. Then, it calls for a battery weighing some seven pounds or so to be carried on the back with a lead dangling (something like a mid-Victorian Chinese pigtail) between cap and battery—a lead to catch on things as one climbs down a raise. As a matter of fact, it is reported that attempts to introduce electric cap lamps in coal mines have often been strenuously opposed by the miners, save where gas conditions were so bad as to make this type of lamp desirable despite its inconveniences. More than once, moreover, the assertion has been heard that better ventilation would mean less gas and thus make the electric lamp unnecessary, but that the lamps were cheaper than better ventilation.

If, after all, the electric lamp has advantages for the metal miner that outweigh its disadvantages, it will probably win its way as the carbide lamp has done. But no reason exists for making its use compulsory in metal mines.

It may not be amiss to add that this is not intended as a brief for the manufacturer of carbide lamps any more than Mr. Harrington's statement is intended to help the maker of electric lamps.

Uses of Waste

HERBERT HOOVER has done well in campaigning against waste as one of the enemies of efficiency, and has shown good advertising sense in inventing and reiterating a slogan: "The Elimination of Waste." The early history of the exploitation of superabundant natural resources—as the forests, the fisheries, and the mines—marked a disregard of waste, a skimming of the richest and the neglect of the rest, which differed greatly with the custom in older and more careful countries. Now not only major products but byproducts are utilized, or uses are sought for them: the new maxim is to emulate the pork packer, and use all of the pig except the squeal. The mining industry has learned how to use low-grade ores, once thrown on the dump, or abandoned under-ground; to treat complex ores and find a market for the different metals contained. Even the earthy gangues of the ores are cleaned and marketed in some instances, and the future may see an increase in this.

Side by side with the Hoover campaign for the elimination of waste comes President Coolidge's drive for economy; and in some cases the two are one. Economy reduces our taxes: it also enables us to wear one winter coat where we bought two before.

There is another side to the question of waste and extravagance. When President Coolidge had his old hat blocked and cleaned for Easter, instead of buying a new one, a roar of indignation arose from the hat manufacturers of the nation. Let the American people emulate this example, and the hat industry of America would be plunged into depression and bankruptcy. When fashion suddenly decreed that women should change from wearing as much clothes as they could carry to as little as they could, the textile industries of New England went into eclipse, the stock of the American Woolen Co. slumped and brought loss to thousands, and the cotton planters of the South appealed to the government for relief. For every inch that skirts have progressed upward, a certain fringe of textile mills, of cotton plantations, have gone out of existence with a loud report. Should the country economize reasonably in automobiles, running a car to the bitter end before turning it in for a new and shiny one, the automobile industries would again see very bad times. Should all the food which is dumped into the garbage cans of the nation be utilized to the last scrap in the households, as could easily be done, the farmers of the nation would find their products far less in demand than at present. And so on, down the line—railroads and most other industries. The tremendous wastage of the war gave the opportunity for American industries to forge ahead at full speed.

The problem of the future will be, it is commonly said, to increase consumption. Production has already been speeded up so that the problem is where the goods are to be sold. Advertising, which proclaims itself to be in part the art of creating new desires—and in so far selling people things they do not need, or did not know they needed, which is much the same thing—becomes an indispensable feature of the trade cycle. Under these present conditions, then, a habit of extravagance and wastefulness as to hats is the hope for an expanding hat industry and the prayer thereof; and so on down the line.

The mining industry, in order to attain normal expansion consistent with the times, has had to study marketing—to advertise—first copper, then zinc, molybdenum, now silver. New sales depend upon the amount of old material used up, whatever the manner of consumption; the more complete the consumption, the better for the producing industry. The copper-mining industry is hampered by the recovery and trade movements of scrap copper, and breathes more freely when stocks of it are exhausted.

The protection of metals from corrosion has recently attracted much study from chemists, and notable results already appear. To the extent that such waste can be eliminated in the machinery and equipment of various manufacturing industries, their losses will be less, their profits greater; but in proportion as less metal is required, due to making the old metal last longer, the demand upon the mining industries will be abated.

Thus the extravagances of one group are favorable to the prosperity of other groups. The flush tipper loses, but the waiter thrives. And in a society where everybody buys, whether he needs it or not, prosperity will be more universal than in a society where nobody buys what he could exist without—because in the former case each is spurred to better and more competitive production. This theory will work out till it comes to the unincreasable or unreplaceable natural resources which furnish the start for the whole complex whirl of industry; but an exhaustion of these resources means a forced slowing down of all. It is for the ultimate benefit of all, therefore, that waste in consuming metals be avoided, although it is not conducive to the prosperity of the contemporary miner. A shining example is gold, a naturally non-corrodible metal. The world still has in its vaults half of the gold produced since 1492—some $19,500,000,000. Compared with this the present annual production of less than $400,000,000 is relatively slight; and the result is that there is no life in the demand for new-mined gold, and the gold miner looks in vain for the boom times of flush prosperity which have been granted to all the manufacturers of rusted, moth-eaten, rotted and wasted products.

Mining Success

FIVE INGREDIENTS FOR SUCCESS in mining were named by the club-car passenger—a physician who had become financially interested in a small property in the West. First you must have the property, he said. Then the money—lots of it; then business and organization ability; then technical knowledge; and, lastly, grit and perseverance to stick it out. So far, good! An excellent place to stop for one more versed in human ills than mining. But he continued, evidently to show how easy it was—"And there are lots of properties in the West." Whereupon the edifice of his reputation crashed, even though many a Chamber of Commerce might agree. Lots of properties, properties with sufficient ore to net a profit if financed with sufficient funds and ably managed! Perhaps there are, but, if so, why do they elude the careful search of the numerous well-financed exploration companies in the field? The doctor was wrong: prospects sufficiently promising to warrant the expense of development and equipping are scarce as the proverbial hen's teeth in these United States, as every mining scout will tell, however plentiful they may be beyond the country's borders.

The Electric Power Shovel

Advantages of Variable Voltage System and Equipment Called For—A Simple Method of Limiting Motor Torques Where Mechanical Damage Might Otherwise Result—Other Features

By R. W. McNeill
General Engineer, Westinghouse Electric & Manufacturing Co.

R. W. McNeill

PRESENT indications are that the use of the electric power shovel is rapidly becoming universal on all excavation projects where the period of operation will extend over considerable time. This trend is evidenced by the facts that several large operating companies have replaced existing installations of steam power shovel by electric within the last few years and that the electric power shovel has been chosen for the more important new power shovel installations. This general tendency has been brought about only after thorough investigation and exhaustive tests on the part of owners and operators, and the final adoption of the electric machine by some of the largest power shovel users in the world is convincing evidence that this type of machine has passed through that transition stage, where it was regarded more or less as an experiment by owners and operators, until today it occupies the position of a tested and proven piece of equipment.

At present, the largest users of the electric power shovel are coal and ore mining companies; quarries, whose product is used in crushed form, as for blast-furnace purposes, road material, or cement manufacture; steel plants for handling ore and slag, and contractors on dams, canals, tunnels and other large projects requiring extensive excavating operations.

The outstanding feature of the electric power shovel as compared to its chief competitor, the steam power shovel, is its uniformly lower maintenance and operation cost. Various factors are responsible for the high maintenance and operation cost of the steam machine. In one locality one factor may stand out predominantly, while on another project the responsibility will rest with a different factor. Operating costs on the steam machine are affected not only by the character of material to be handled, but also by local conditions as to transportation cost and primary cost of fuel and water, and the quality of water available for use in the boilers. This means that operation costs of steam power shovels

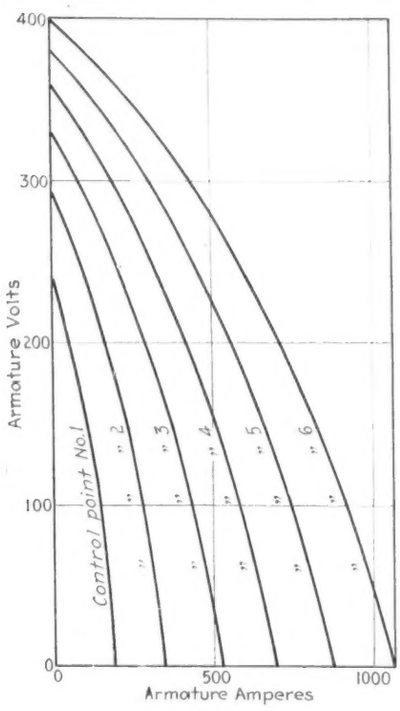


Fig.1

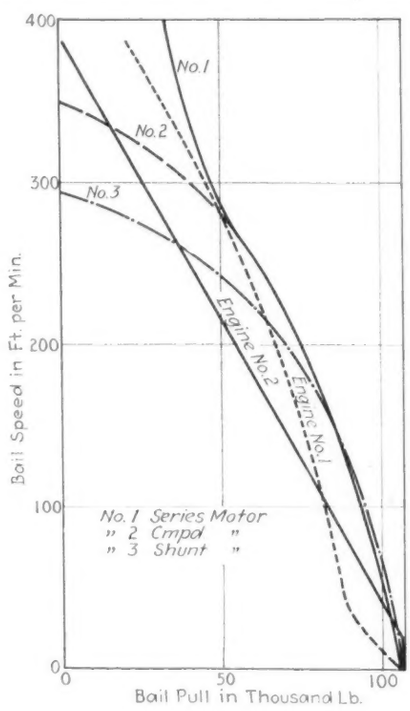


Fig.2

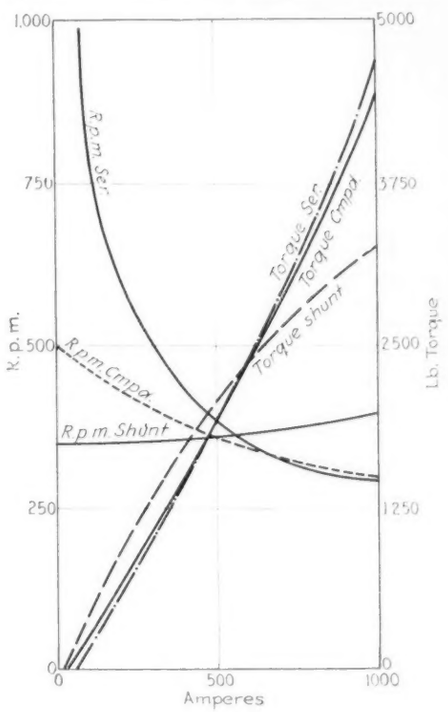


Fig.3

Fig. 1 — Shows characteristics of typical differential compound-wound d.c. generator for power shovel service, under different conditions of separately excited shunt-field strength, and with different values of load current. Fig. 2 — Shows similarity of speed-torque curves of electric power shovel, using the variable-voltage system, with differentially compound-wound generators, to speed-torque curves of the steam power shovel. Fig. 3—Shows speed-torque characteristics of the three types of motors

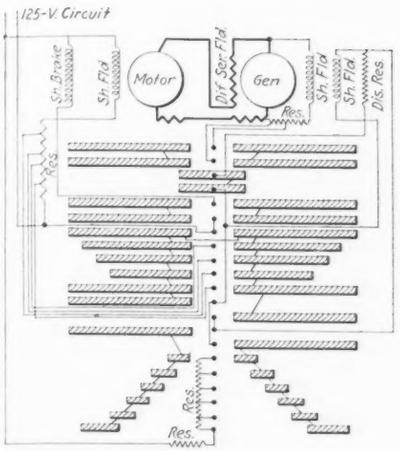


Fig. 4

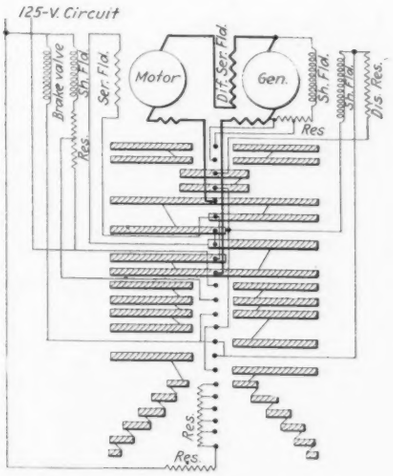


Fig. 5

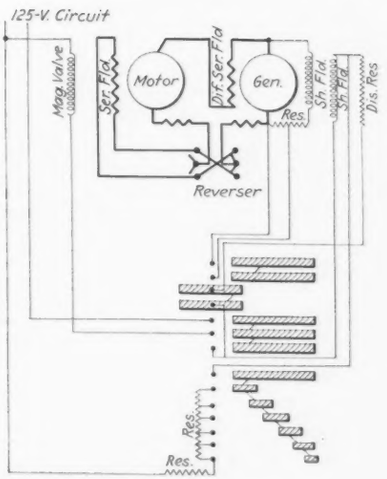


Fig. 6

Figs. 4, 5 and 6—Typical control connections for shunt-compound and series-wound motors respectively, when operated by the variable-voltage system with differential compound-wound generators

may vary over a considerable range. With the electric power shovel, however, operation and maintenance costs are determined almost entirely by the character of the material to be handled, as the cost of power and cost of transmitting power to the shovel is subject to but small variations, and as a usual thing is not an important item in the total operating cost of an electric shovel. Labor costs are lower on the electric than on the steam machine because less labor is required.

In actual operating characteristics and features, the electric power shovel does not differ materially from the steam power shovel, and an operator experienced in handling the steam machine requires little additional instruction to be able to handle the electric machine successfully. The speed and power of a well-designed electric power shovel should be approximately the same as that of a well-designed steam power shovel of the same type, size and dipper capacity.

The general adoption of the electric power shovel has led to a considerable development in connection with this class of machine, not only in connection with the electrical equipment but also in connection with the general mechanical design. This has resulted in a well co-ordinated design so that today the purchaser of an electric power shovel gets a machine especially designed for an electrical operation. Mechanical improvements have taken the form of better gearing, double helical gears having been substituted for coarse spur gears in many instances, in better bearings, and in better system of lubrication for bearings, gears, and the like. Electrical improvements have been along the line of securing greater simplicity and ruggedness in the electrical equipment used.

The Variable-Voltage System

The latest development in electrical equipment for power shovels, the variable-voltage system, gives remarkable simplicity and flexibility of control and permits sturdy rugged construction in all details of the equipment. With this system, a separate d.c. generator is required to furnish power to a separate d.c. motor used on each motion. The armatures of these machines are connected directly together electrically, and control of each individual motion is obtained by varying the voltage of the individual generators.

The direct-current generators used for supplying variable-voltage power for the motors of the various motions of the electric power shovel are of the differentially compound-wound type, designed with three separate field windings—namely, a separately excited shunt winding, a self-excited shunt winding, and a differential series winding. By proportioning these windings properly, it is possible to secure a generator having ideal characteristics for power shovel service. This type of generator will deliver variable-voltage power to the motors, the exact voltage at any instant depending on two factors—namely, the value of excitation in the separately excited shunt-field winding, and the value of the load current. The use of this type of generator results in remarkable simplicity of control features and great flexibility over control of the operations of the shovel.

The electric power shovel can be used wherever transmission lines can be built. As a usual thing, power supply is from an alternating-current source, though in certain rare cases it may be desirable to operate from a direct-current source. Typical electrical equipment for a variable-voltage-equipped power shovel

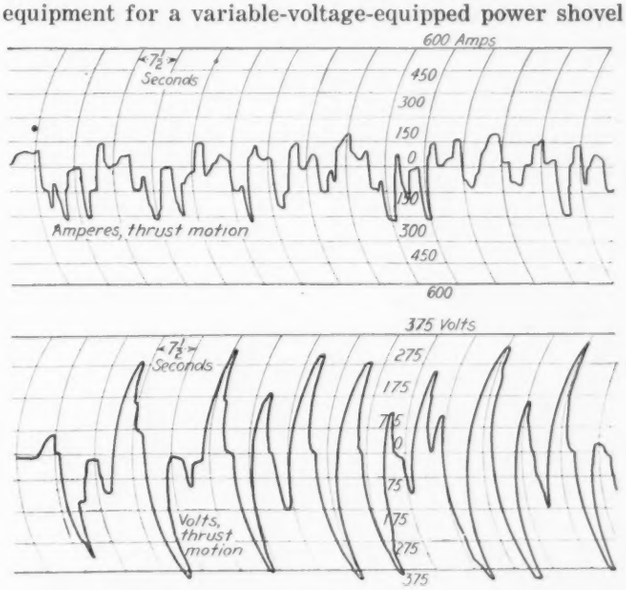


Fig. 7—Typical test curves taken in a 4½-yd. railway shovel showing thrust motion; 30-kw. generator, 50-hp. motor

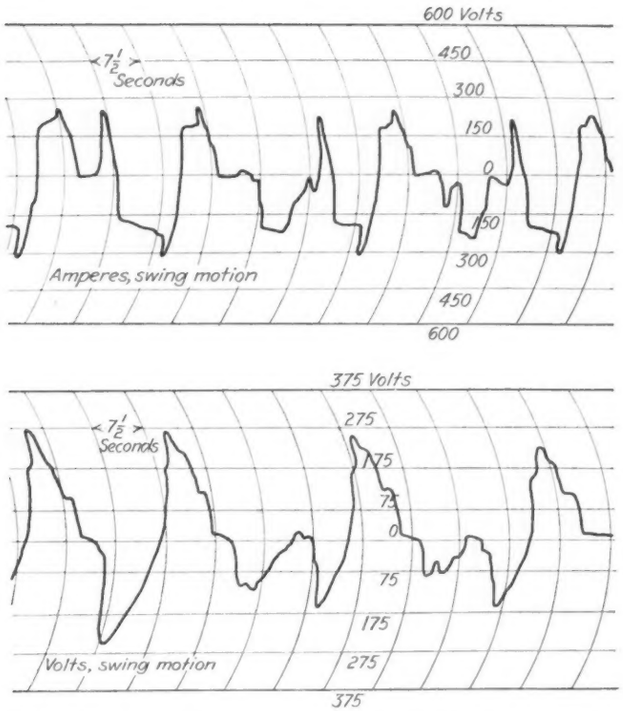


Fig. 8—Typical test curve taken in a 4½-yd. railway shovel showing swing motion; 30-kw. generator, 50-hp. motor

in the order of location from the power line will consist of:

1. Starting equipment for main motor driving a main motor-generator set.
2. Main motor-generator set.
3. Controllers and field resistors.
4. Shovel motors.
5. Auxiliary equipment, including exciter motor-generator set, motor-driven air compressor, transformers if power source is high voltage, magnet valves, dipper trip motor, and the like.

Starting equipment for the main motor-generator set is made of rugged construction and kept as simple as possible. In many cases it will consist only of an across-the-line type starter. This will be especially true of sets driven by induction motors. In the case of large equipments driven by synchronous motors, reduced-voltage starting will usually be used. Where this is the case, the usual practice is to furnish a combined panel and structure for starting the main motor and for control of the exciter.

The main motor-generator set of a variable-voltage-equipped electric power shovel consists of a driving motor and two or more direct-current generators. Sometimes an exciter is added to this set, but in the majority of cases space limitations make it necessary to furnish a separate motor-driven exciter. Various mechanical arrangements are possible for this set, the most common being: (1) A two-unit set, mounting the driving motor, hoist generator and exciter (if direct-current connected) on one bedplate and the swing and thrust generator on a separate bedplate. If this construction is used, the two units are connected by a flexible coupling. (2) A two-bearing four-unit set, the driving motor, hoist generator and swing and thrust generators being mounted on a common bedplate with the rotating parts assembled on a common shaft.

The main driving motor may be either of the synchronous type or of the squirrel-cage induction type. The synchronous motor is favored on larger equipments because of the higher power factor obtainable with this type of machine. On the smaller shovels the induction motor is favored because of its simplicity. On the larger outfits, motors are usually wound so that they can be used either on 2,200 or 4,000-volt service by making a simple change in connections. On the smaller outfits, the motors are wound for a single voltage, the range usually extending from 440 to 2,200 volts. Lower voltages than 440 are not recommended for electric power shovels, due to the difficulties in transmission of power at lower voltage for any considerable distance.

As previously mentioned, the direct-current generators used for furnishing power to the various motions are of the differentially compound-wound type. With the variable-voltage system, motor speed and torque are a direct function of the voltage of the generator. Motor-speed control is obtained almost entirely by variation in strength and direction of current flow in the separately excited shunt field of the generator, while current in the armature circuit is limited to a predetermined maximum value by the action of the differential series field on this generator. Fig. 1 shows characteristics of typical differential compound-wound d.c. generator for power-shovel service, under different conditions of separately excited shunt-field strength, and with different values of load current. Fig. 2 shows the similarity of speed-torque curves of the electric power shovel, using a variable-voltage system with differentially compound-wound generators, to speed-torque curves of the steam power shovel.

Mechanically, the control equipment necessary with variable-voltage-equipped shovels is of the simplest character. All controllers are of the same general type and construction, though they may differ as to operating and structural details. Present practice is to use small drum controllers, and series resistors connected in circuit with the separately excited shunt fields of the individual generators, in such a manner as to control the current strength and direction of current flow in these fields. Additional contacts are regularly provided in these controllers for weakening the self-excited shunt

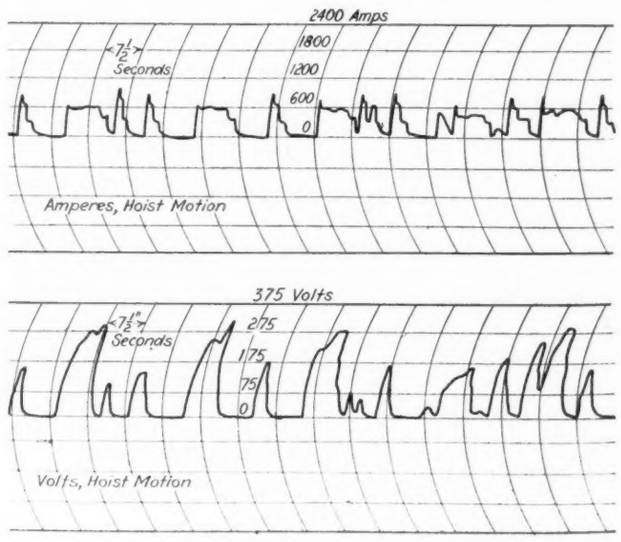


Fig. 9—Typical test curve taken in a 4½-yd. railway shovel showing hoist motion; 125-kw. generator, two 95-hp. motors

field of the generators in the "off" position, for connection of field discharge resistors, for operation of brake and clutch circuit, and for control of motor field circuits.

Standard controllers are provided with vertical operating handles, which may be provided with auxiliary thumb-operated switches for operation of the dipper trip mechanism, magnet valves, and the like. When desirable, a special foot-operated controller can be furnished for operation of one of the shovel motions, usually the swing or thrust.

The motors used for driving the individual motions on variable-voltage-equipped electric power shovels are of the well-known direct-current mill type, used extensively for auxiliary drives in steel mills, and on heavy-duty cranes and on car dumpers. Open or ventilated-type motors are usually used on the hoist and swing motions and totally enclosed type motors on the thrust or crowd motion. Electrically and mechanically the design of these motors must be of the highest order,

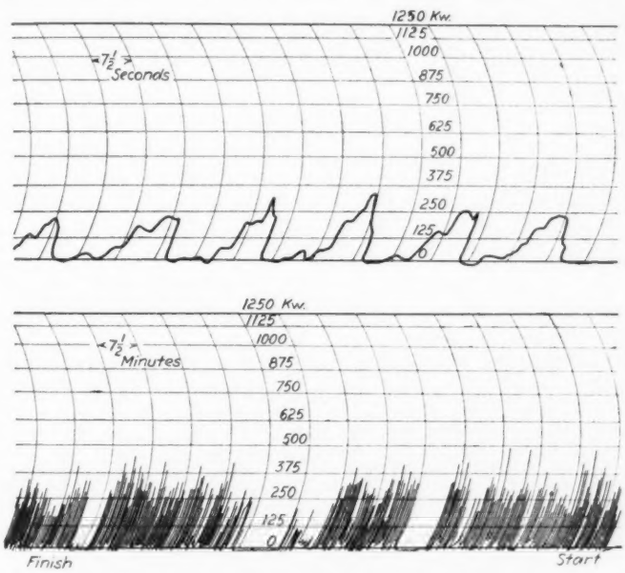


Fig. 10—Typical test curve taken in a 4½-yd. railway shovel showing kw. input, with variable-voltage electrical equipment

as it is well recognized that the service is severe. Due partially to differences in practice of various shovel builders, and partially to differences in requirements on various motions of the shovel, there is some variation in the type of field windings employed on motors for shovel operation. In some cases the motors have a straight shunt-field winding. In other cases compound windings are used, while in still other cases series-wound motors are preferred. Each particular type has certain inherent advantages and no general unqualified statement can be made favoring one type in preference of the other two. Fig. 3 shows speed-torque characteristics of the three types of motors. Control is simplest with the straight shunt motor, for no main line reversers are necessary. On the other hand, the speed-torque characteristic of the compound or series motor are admirably fitted for shovel service, and in certain cases enough advantage can be secured by using these types of motors to offset the disadvantages of control complications. Where regenerative braking is desired, as on the swing and thrust motions to facilitate quick stopping and on the

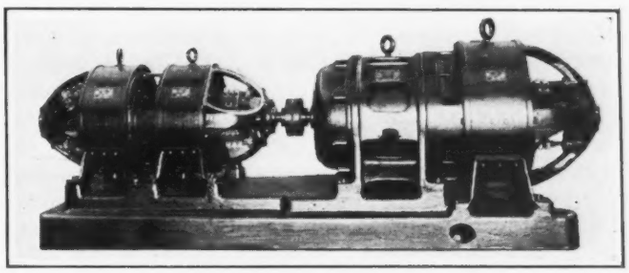


Fig. 11—Variable-voltage motor-generator set used on 1¾-yd. shovels

hoist motion on high lift shovels to secure speed control in lowering, the straight shunt or compound-wound motor is preferred because of the ease with which this feature is secured. The best field for the series motor is for low-lift shovels, where it is the practice to lower the dipper on a mechanical brake, so that the reversal of the motor is required only intermittently, and regeneration is never required. Figs. 4, 5 and 6 show typical control connections for shunt, compound- and series-wound motors, when operated by the variable voltage system with differential compound-wound generators. The diagram for the compound-wound motor applies only in the case of very small motors; for larger motors it is necessary to use contactors for reversal of the series field of the motor or to use a series exciter, to keep the motor field currents within the capacity of the small drum controllers.

Auxiliary equipment usually required with an electric power shovel using the variable voltage system consists of an exciter motor-generator set, a motor-driven air compressor, for operation of clutches and brakes, magnet valves for control of clutches and brakes, and in some cases motor-driven dipper trip mechanism. If power supplied to the shovel is from a high-voltage source, that is, over 550 volts, transformers will be furnished for furnishing low-voltage power to the exciter motor-generator set, the air-compressor motor, and such other auxiliaries as may require low-voltage a.c. power.

In certain cases the air compressor equipment is omitted from the shovel. Magnet brakes are always furnished in such cases for the thrust motion and, at times, for the swing and hoist motion.

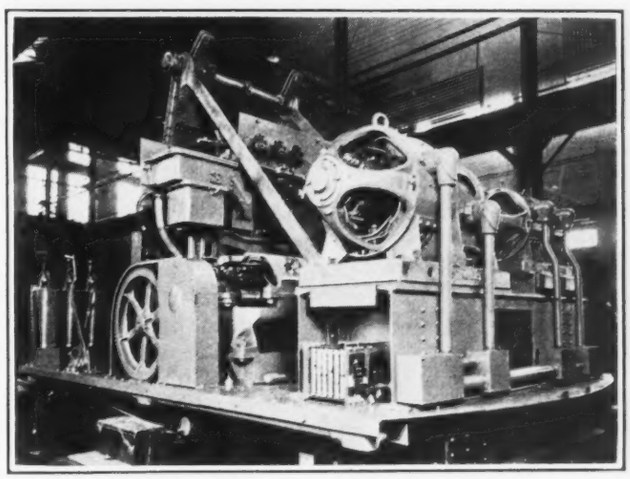


Fig. 12—Shop view of 1¾-yd. shovel showing arrangement of motor-generators, motors and controllers

Typical test curves taken in a 4½-yd. railway shovel are shown on Figs. 7, 8, and 9. These curves were taken on a shovel equipped with series motors for an hoist motion, and shunt motors for swing and thrust.

While the foregoing has referred principally to the application of the variable-voltage system to shovels of the conventional type, it is equally applicable to installations on drag-line excavators, dipper dredges and to hoist and swinging motions on all types of cranes and dredges. The system described provides a simple automatic method of limiting motor torques, where serious mechanical damage might result if these torques were not definitely limited. It also provides a simple method for obtaining high motor torque with low kilowatt input to the motor, without sacrifice of high light-load motor speed. The last feature is valuable where power is purchased on a peak-load basis, or where the primary source of power is of limited capacity.

Stray Electrical Currents

The need for caution in handling electric blasting caps near charged rails or electric wires is pretty well known, but the hazards arising from stray electric currents are less generally understood. The subject of stray currents is one for study by all interested in electric blasting, according to H. H. Hamilton, in the Du Pont *Explosives Service Bulletin.*

By the term "stray currents" is meant the electrical force found on any conductor or material that is not supposed to be charged or carrying electricity. It is impossible to say in what mine, or where, stray currents will be found. Only after a close examination for them can a mine be said to be without stray currents, and it is possible that a mine that is free from them today will have them one year from now.

Many say that stray currents can be found only in mines using electrical machinery and haulage and that they are due to poor bonding. Observations have proved, however, that stray currents can be found in many mines with no electrical wiring or machinery; also that the number of mines showing such currents will greatly increase with the building of more high-tension lines and electric railroads. Most of the electric railroads that operate through the mining districts use 650 volts and what is called a grounded system. This means that electricity is continually passing through the ground.

In mines using electric haulage there is the danger from stray currents in almost every working place. On the main haulage entries where the bonding is good the leakage is not very great, nor, be it noted, are electric blasting caps often handled in this part of the mine. It is the gathering motors and the traveling of motor-driven machines that set the stray currents going, and at times the whole section is sufficiently charged to set off an electric cap.

Electrically driven pumps leak current into the suction and discharge lines, and readings can be taken at a considerable distance from these pumps by testing from the discharge line to the rail.

The author cites the case of a mine with compressed-air haulage and no electrical machinery inside, where at times it is possible to get readings of 5 volts and 1½ amperes and higher, 1,800 ft. from the bottom of a 545-ft. shaft. At the last air-charging station 1½ miles from the bottom of the shaft, a reading of 8 volts and 5 amperes has been recorded a number of times. This reading is taken from the compressed-air line to the rail. The compressors are located on the surface and are steam driven. There is no electricity in the compressor room except the 110 volts electric lighting. Near the shaft bottom no current is found, a fact which goes to prove that the electricity does not enter this mine through the shaft. Along the main haulage more than a mile from the shaft, where the air line and water line are covered with 10 in. of wet slate, a cap can be fired by placing one wire on the dry rail and the other on the wet dirt over the air line. A check on these conditions shows that this current is not regular. The readings vary as much as 4 or 5 volts when taken at fixed points in the north section of this mine, but at all times the current is found after going a distance of 1,000 ft. from the shaft.

In another mine where the only electrical machinery used is an electric pump driven by 440 volts alternating current, which comes down a bore hole about 300 ft. from the pump in a lead-covered cable, which, in turn, extends from the transformer on the surface to the pump switch in the pump room, the men working along the track reported electricity on the rails. An investigation was made, and while the voltmeter available would not register alternating current, it was found that an electric squib could be fired at times from the rail to the discharge line from this pump. All connections and everything about the pump have been carefully examined and are in first-class condition; yet there is at this time current returning from this pump through the discharge line. If this pump were pumping into the sprinkling line, as is often the case, this stray current would probably go into the working places.

Since there are stray currents in many mines, their detection is not difficult. Most of the mining men who are interested are using a small voltmeter of the magnetic type. In selecting a voltmeter for this purpose, it is best to get one where the indicator is at rest in the center; then you get a reading on the first test, as the indicator will move in either direction according to the way the current is traveling. These voltmeters are inexpensive, and need only to be equipped with longer wires. They are easily carried.

An efficient test for stray current can be made with an electric squib by simply touching the suspected wires, rails, or pipes with the two wires of the squib. A current too weak to fire an electric squib would probably be too weak to fire an electric blasting cap, whereas a current strong enough to explode a squib would certainly be a source of danger if it should get onto the wires of an electric blasting cap.

As to curing stray currents, the author does not believe that there is anything that will get rid of them, and he is of the opinion that the mines and quarries will show them more and more each year. It is said that all the current generated by any generator finds its way back to the generator, no matter how far it is carried, and it is supposed to return through the ground. For this reason electric railroads are grounded as often as possible by connecting wires from the rails to pipe lines and water holes along their lines.

Ore Possibilities at the Congress Mine

Geological History of This Interesting Old Property Suggests Advisability of Further Exploratory Work and Development

By W. F. Staunton
Mining Engineer, Los Angeles

W. F. Staunton

THE original locations of the Congress mine in the Martinez mining district, in Yavapai County, Arizona, were made by Dennis May and sold by him to "Diamond Joe" Reynolds about the year 1887 for approximately $65,000, the purchase having been made by the advice of Frank M. Murphy, of Prescott.

Reynolds developed the property to some extent and built a 20-stamp mill with Frue vanner tables for concentration. No amalgamating plates were used, as there was practically no free gold, all of the value being in the sulphides, which consisted principally of marcasite. The surface ores were much oxidized, in spite of which no saving of consequence could be made by amalgamation or by concentration. The cyanide process was in its infancy then and little known, so that it was commonly said of the Congress mine in its early history that though it showed much good ore, there was no known method of extraction. The finding of sulphides by sinking solved the problem to a certain extent, as such ores were amenable to concentration and the concentrates could be shipped to custom smelters. This furnished the means to profitable operation, but the crude methods employed at that time—fine crushing by stamps followed by simple unclassified concentration on Frue vanners—necessarily resulted in high tailing losses on account of the large amount of sliming that took place. Flotation, as practiced today, was then unknown. Fortunately the tailings from the early operations were saved and were re-treated later by cyanide with good extraction.

The property was operated from March, 1889, to August, 1891, when owing to the death of Mr. Reynolds, and to await the construction of the Santa Fe, Prescott & Phoenix R.R., active operation was suspended except for a certain development work and the enlargement of the mill from 20 to 40 stamps with the necessary additional Frue vanners. The No. 2 shaft had been sunk to a depth on the vein of 1,000 ft., but no stoping had been done below the 650-ft. level.

Production during this early period was as follows:

	Tons	Net Returns
March 3, 1889, to Aug. 31, 1891, ore shipped.....	1,129.4	$155,652.29
Sept. 26, 1889, to Jan. 28, 1891, concentrates shipped.	2,500.8	335,308.87
June 3, 1891, to Aug. 31, 1891, concentrates shipped..	1,062.8	101,113.73
	4,693.0	$592,074.89

In March, 1894, new interests acquired control of the company, the name of which then was the Congress Gold Co., with E. B. Gage, president, and active operations were resumed, continuing thereafter until the end of 1910. In April, 1901, the company was reorganized as the Congress Consolidated Mines Co., Ltd., E. B. Gage continuing as president. The writer had direct supervision, first as superintendent and later as vice-president and general manager, from 1894 to 1910.

The production during this second period was as follows:

	Net Returns
March, 1894, to Dec., 1910, ore and concentrates shipped.....	$4,259,571.30
March, 1894, to Dec., 1910, cyanide bullion shipped.....	2,797,851.45
	$7,057,422.75

Thus the total recorded production in actual returns for gold and silver sold was $7,649,497.64.

GEOLOGY—CONGRESS VEIN IN GRANITE

The country rock is granite, the westerly slope of the Bradshaw Mountains. A series of greenstone trap dikes exists over an area of several square miles, having a strike that is generally east and west and dipping north 20 to 30 deg. These dikes are generally mineralized to some extent and the Congress vein is in one of them and perhaps it can be said that the dike is the vein, for ore occurs in it in all possible positions from one granite wall to the other but generally near the footwall and accompanied by a clay selvage. The dike has a thickness of about 15 ft. Another series of dikes of fine-grained quartz porphyry is of later origin, apparently post-mineral, and strike northeasterly with nearly vertical dip. The following analysis of an average specimen of the greenstone was reported from the Sheffield Scientific School: SiO_2, 52.20 per cent; Al_2O_3, 13.40; FeO, 9.75; MnO, 1.90; CaO, 9.60; and MgO, 1.16.

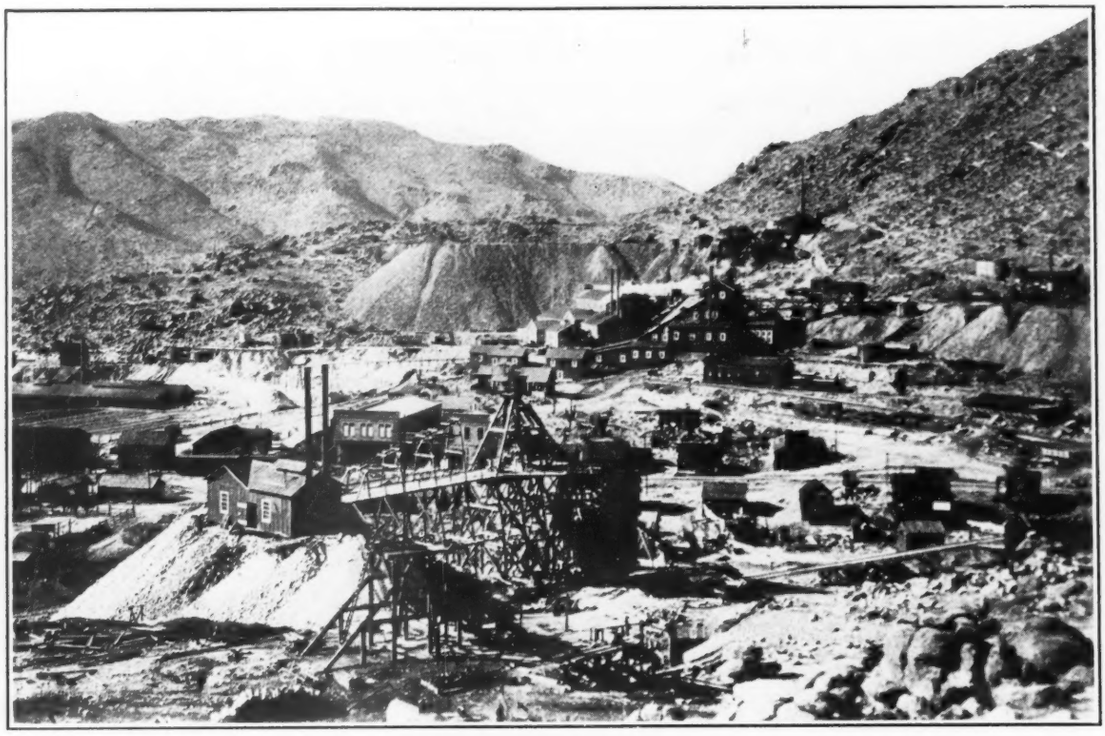
There are other veins, entirely in the granite and unaccompanied by the greenstone so characteristic of the Congress vein. These strike east and west, but dip more steeply, from 40 to 50 deg. The development of quartz is more extensive than in the Congress vein and the average grade is lower. One of these veins, the Niagara, carried large bodies of ore of commercial grade to a depth of 2,000 ft. A characteristic of these all-granite veins is the presence of a small amount of galena and higher silver contents.

Minor faulting is in evidence throughout the mine workings and there has been considerable relative movement of the walls of the Congress vein, resulting in local crumpling of the greenstone. The mine workings terminate to the east against a heavy fault, beyond which the vein has not been definitely located. This fault cuts off both the Congress and Niagara veins.

MINE WORKINGS DRY

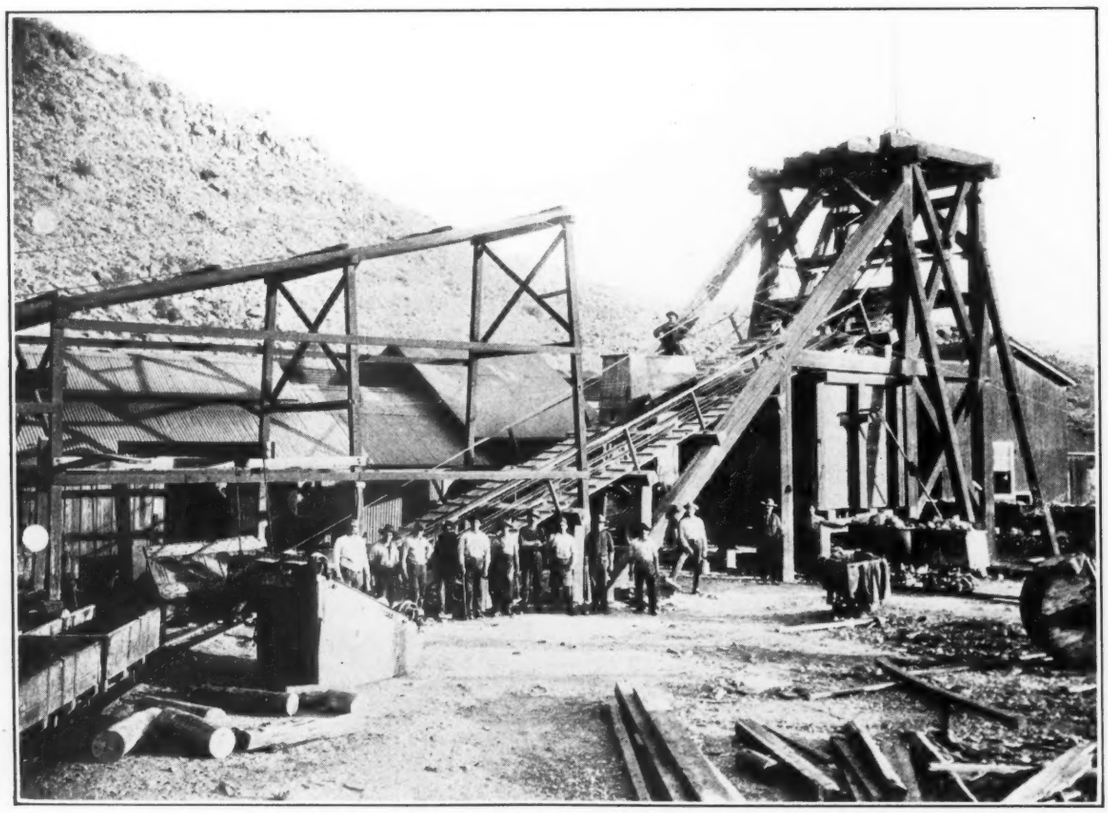
The mines were practically dry down to the deepest point reached, 4,000 ft. on the Congress vein at an approximate inclination of 25 deg. from the horizontal, the small amount of surface water which found its way in being easily handled by bailing tanks in the shafts. No mine pumps were ever put in or needed.

Although the Congress vein is continuous and well



Congress mine, Arizona, about 1905. At left is cyanide plant. No. 5 shaft on Niagara vein in foreground. Above stamp mills (in center) is No. 2 shaft and at right is No. 1 shaft, both on Congress vein

defined for a mile or more to the west of the mine workings and shows both the characteristic quartz and sulphides, the pay ore was practically confined to a shoot in the vein pitching to the northwest and coinciding closely with the intersection of one of the fissure veins in the granite. The granite vein is faulted by the Congress vein so that the intersection is obscure in the mine workings. The portion of the granite vein in the hanging wall of the Congress carried bodies of pay ore.



No. 3 shaft on Congress vein. It is 4,000 ft. deep on a 25-degree incline

The Congress pay shoot varied greatly in length on different levels, being longest on the 650 ft. level, where it was stoped continuously for 1,800 ft. The average thickness of pay ore was less than 3 ft. Several pinches were met in following the vein down, the most serious being at the 1,700-ft. level, where there was no stoping ground. On the theory that if pay ore existed below that point it would probably be found on the general line of trend of the ore shoot above, a deep prospecting winze was sunk from the 1,700-ft. level, in the vein but with a northwesterly pitch corresponding to the established trend of the pay ore in the upper workings. This winze was sunk 1,000 ft. and bore out fully the theory upon which it was projected, the pay ore coming in again as good as ever after a few hundred feet of lean ground.

The 3,900-ft. level was the deepest point at which any considerable amount of development was done. For several levels above this there had been a gradual pinching of the pay shoot, which became small and irregular, although retaining its mineralogical characteristics and the small amount of sulphides which remained still showing the characteristically high gold contents, about 7 oz. per ton. The conditions were similar to those existing at other horizons in the mine where persistent deeper work had been rewarded by expansion of the ore shoot to normal size.

Seven shafts were sunk, all of them inclines following the veins. Three of these were on the Congress vein, designated as No. 1 (1,100 ft.), No. 2 (1,700 ft.) and No. 3 (4,000 ft.). On the Niagara vein three shafts were also sunk, No. 4 (1,000 ft.), No. 5 (2,050 ft.) and No. 6 (1,800 ft.). On the Queen of the Hills vein one shaft was sunk to a depth of 200 ft. below the tunnel level.

Total Tonnage Produced 692,332

Figures on tonnage of crude ore are not available for the first period from March 3, 1889, to Aug. 31, 1891, but on account of the great uniformity of the ore they may be closely approximated from the figures of the later period, on which basis the amount of ore milled in the first period appears to have been about 70,000 tons, all of which came from the Congress vein, as also did the shipping ore, together making a total of 71,129 tons. In the second period the amount of ore milled was 617,542 tons and shipping ore 3,661 tons, a total of 621,203 tons. The figures may be grouped as follows:

	From Congress, Tons	From Niagara, Tons	From Queen of the Hills, Tons	Total, Tons
March 3, 1889, to Aug. 31, 1891.....	71,129	.....	.....	71,129
March 1, 1894, to Dec. 31, 1910.....	307,863	293,215	20,125	621,203
	379,022	293,215	20,125	692,332

The recorded production of gold and silver in shipments shows a total of 388,477 oz. of gold and 345,598 oz. of silver. As this came from 692,332 tons of ore, a recovery is indicated of $11.81 a ton, gold being figured at $20.67 and silver at 60c. per ounce. Average tailing assays were about $1.20, which indicates a gross average value of all ore mined of $13.01.

The history of the Congress mine, its remarkable persistence due probably to its association with an intrusive dike of profoundly deep origin, and the existence of similar parallel veins in both hanging and footwall over a wide belt, suggest a careful study of the whole situation to determine the feasibility of a broadly planned scheme of exploration by means of a vertical shaft so arranged as to cut the Congress vein at greater depth than has been attained and incidentally to cut and explore the other similar veins, many of which not cut by the shaft could be reached by crosscuts.

Brass Direct from Mixed Ores

A process described by A. W. Guertler in *Metall und Erz* (1926, 23, 325) produces brass in a novel way. By melting sulphide ores of lead and zinc with metallic copper in excess, copper matte and a mixture of metallic lead, copper, and zinc are formed, which separate, in the liquid state, into a layer rich in lead with little zinc, lead, and a copper-zinc layer with little lead. The last-named is melted with copper and yields a serviceable brass.

The Alderson-McKay property at Rouyn

American Prosperity

A Study of Its Causes—How Other Countries May Attain It

By Arthur Notman
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Arthur Notman

THE active and acrimonious discussion of war debts and the simultaneous references to American prosperity seem to lead the minds of some people on both sides of the Atlantic to believe or profess to believe that some casual relation exists between the two. One of the most recent contributions to a growing mass of sound thought on this subject has been furnished by Dr. T. T. Read, Assistant Secretary of the American Institute of Mining and Metallurgical Engineers, quoted by Dr. H. F. Bain, secretary of the same organization, in a very thoughtful address before the Williamstown Institute of Politics, an abstract of which was published in the September issue of *Mining and Metallurgy*. Dr. Read has shown that the Anglo-Saxon nations lead the world in the per capita consumption of mechanical power. The relative positions of the leading nations is shown in Dr. Read's table, as follows:

Per Capita Consumption of Mechanical Power

1925

	hp.		hp.
United States	36.0	Holland	7.5
United Kingdom	24.0	Poland	4.2
Canada	22.0	Italy	3.1
Belgium	19.0	Japan	2.2
Germany	15.0	Russia	1.6
Czechoslovakia	11.5	India	1.4
Australia	10.0	China	1.2
France	9.7		

To this impressive comparison we might add the fact that the United States, followed by the United Kingdom and Canada, also leads the world in the per capita consumption of all the important raw materials of mining and agriculture on which the manufacturing industries of the world are based. It follows logically, even if direct proof were lacking, that, other things being equal, we should find that the United States produced more of those raw materials per unit of labor expended than the other nations of the world. I have referred in these pages before to the fact that the domestic porphyry copper mines produce from ores averaging less than 1.5 per cent copper about 150 lb. of blister copper per man-shift employed in mining, milling and smelting, while the Katanga from ores averaging over 7 per cent produces only about 35 lb. of the metal per man-shift. No doubt other industries would reveal similar significant comparisons. With all these favorable factors as a basis, it is only natural that the United States should produce a vastly larger sum total of wealth per capita than the rest of the world. Evidence is not lacking to show that this difference is widening rather than narrowing. It will doubtless continue to do so as long as the rest of the world is led by politicians in the ranks of both labor and capital with fallacious theories of political economy.

Exchange of Ideas Beneficial

The free flow of men and ideas between the Anglo-Saxon countries, and more especially across our northern borders, has doubtless been mutually beneficial and stimulating. Perhaps this accounts, in part at least, for the relative ascendancy of North America in the per capita consumption of power and the present phenomenal development of additional power resources on this continent. Power is the source of all wealth reduced to its simplest terms. Throughout history those individuals and nations who have commanded the services of the most labor have become the most powerful and the wealthiest. The mere possession of natural resources will not result in wealth. If it did, Africa might long ago have become the richest continent of the world. Far more important than these is the wise conduct of human affairs which enables the intelligent men of initiative in the country so to utilize those resources as to multiply the effectiveness of the labor of all, thereby greatly increasing the product available for division among them. No policy which overlooks the importance of self-interest through an equitable division of this product can ever hope to maintain maximum effectiveness in a nation any more than it can in a single industrial organization. The first and most important step by any nation is the recognition by a substantal majority of her people that in this direction lies prosperity. The blacks of Africa may be dimly aware of their natural advantages, but they are without the initiative to seek a remedy for their poverty, and even under the intelligent guidance of Anglo-Saxons, it may take generations to enlighten them, if that is ever possible.

To illustrate: A comparison of the official 1925 figures covering the operations on the South African Rand with those of the Hollinger Consolidated Gold Mines, Ltd., in Ontario, Canada, shows the following significant facts:

	Rand	Hollinger
Tons ore per man shift	0.406	1.993
Average earnings per shift	$0.92	$4.81
Cost of labor per ton	$2.22	$2.40
Yield per ton	$6.52	$8.18
Yield per man-shift	$2.64	$16.30

Note—Sterling exchange taken at par.

The earnings in both cases include all wages, salaries and bonuses paid out and are based on the assumption that the average number of employees given in the figures worked 365 days. In the case of the Rand only 10.5 per cent of the total force were whites who earned an average of $4.87 per shift, while of the balance 88.8 per cent were natives and 0.9 per cent Asiatics and others. These, together with the natives, averaged 46.6 cents per shift. In other words, the supervisory force actually received a larger sum total than the workers, although they were outnumbered nine to one by the latter. I have not the figures at hand to make direct comparison with the Hollinger in this regard, but as nearly as I can judge, the "workers" in Canada received about 82 per cent of the total paid out for wages and salaries or four and one-half times the amount received by the supervisory, advisory and accounting staffs. The net results in labor cost per ton milled are very close, but the value produced per man-shift in the case of

the Hollinger, even if we assume the yield per ton to have been no higher than that of the Rand ores, would have been $13 against $2.64 for the Rand, almost five times as great.

Superior Intelligence and Organization Responsible

It is idle to suppose that these differences are due to any inferiority in the methods or equipment used. The Rand has long been considered a model for the gold mining industry in these respects. They are in part due to inherent differences in the physical problems encountered, although I am unable to hazard an opinion as to which holds the advantage in this regard. In the main, however, the differences are due to the superior intelligence and organization of the respective forces as a whole and that of the communities on which their operations are based.

The sooner Europe, Asia and Africa cast aside any envious thoughts of our prosperity and apply themselves without prejudice to the study of its real sources, the sooner they will share a like prosperity. Incidentally, they cannot improve their positions without enhancing ours. The widespread distribution of wealth in this country is the most helpful thing the world has to contemplate.

Liability for Injuries to Workmen in Mines

By Leo T. Parker
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A WORKMAN is presumed to assume the usual risks of the kind of work he undertakes to perform, according to an established rule of law, and if he receives injuries without negligence on the part of the employer, generally, the employee cannot recover damages. Placing the fault of an accident is very often most difficult, however, and if an employee is ordinarily careful at the time of an accident, a court may be inclined to render a decision in his favor. In the cases cited in the next few paragraphs, it is understood that the employee was not at fault and that the question of liability for damages consequently lies between other parties.

Frequently there is litigation as to whether or not a mine owner is liable for injuries sustained by employees who are hired and paid by a contractor who independently agrees to dig and deliver ore to the mill or smelter, at a certain cost per ton. It has been held that a mine owner is relieved of liability for damages, as a result of injuries sustained by workmen, when the contract entered into with the contractor contains a clause that reads as follows: "It is agreed that the owner of the mine shall in no wise have control of the mine from which the product is mined, or any authority respecting the manner of or means employed or about operating the mine."

The contents of this clause implies that a mine owner has no legal authority over the men employed to dig, blast, and perform other work, and is an important restriction in order that the liability shall be borne by the contractor.

For example, in a case decided recently, it was disclosed that the owner of a mine entered into a contract with a firm that agreed to perform all of the necessary work required to remove ore from the mine. The contract contained a provision which specified that the work of making the mine safe was to remain under the supervision and control of the owner's superintendent. Later litigation developed and the effort was made to have the owner held liable for the injuries sustained by a workman paid by the contractor. The court in effect said that it is quite natural to expect that the owner of a mine has a great interest in the proper maintenance and preservation of the mine's property, and the provisions in the contract which gave him the right to supervise the mine for the purpose of maintaining it in good condition did not produce a relation whereby he might be held responsible for injuries received by workmen who are employed, paid, and retained under the exclusive control of the contractor.

On the other hand, in another case it was disclosed that a mining company entered into a contract with a contractor for the removal of ore, the contract stipulating that the mining company retained the privilege of making arrangements which were considered necessary for the protection of the workmen. The court held the mine owner liable for damages as a result of a laborer being injured by rock falling from a wall in the mine. In this instance the mine owner was held liable, even though the workmen were employed and paid by the contractor.

In another case a contract was entered into between a mine owner and a contractor whereby the contractor was to dig ore and deliver it upon cars furnished by the owner, at a fixed price per car. In litigation which resulted because a workman was killed, the court held that the owner of the mine was not liable for the payment of damages, because the stipulations of the contract were such that the owner assumed no control of the men who were employed to remove the ore.

Occasionally it has been sought to hold both the mine owner and contractor liable for damages as a result of a workman being injured, as was done in a recent case in which it was proved that the mine was in the exclusive possession and control of the contractor, who received a fixed rate for each ton of the ore taken from the mine. The court in effect said that a mine owner is not liable for the negligence or carelessness on the part of a contractor who assumes full charge and control of the mine and pays and hires his own men. In this instance, the contractor was held personally liable.

Therefore, it is plainly evident that mere ownership of a mine can impose no liability on its owner for injuries sustained by workmen who are employed in the mine by a person to whom authority is given, by the mine owner, to perform certain work. However, it is important that the mine owner does not retain control over the men employed.

Conditions Different When Work Is Necessarily Dangerous

On the other hand, a mine owner may be liable for injuries sustained by workmen, provided the cause of the injury actually arises from the contract. For

instance, where it was shown that a contractor was not negligent and further that the man injured was exercising ordinary care in the performance of his duty, but the injuries were caused by unusually dangerous excavations necessarily made, the court held the mine owner liable for the injuries, because they actually resulted from the performance of the contract which was entered into between the mine owner and the contractor.

Owner Is Responsible for Work Done Under Dangerous Conditions

This phase of the law is really not difficult to understand, when it is considered that when an undertaking is more than ordinarily dangerous, the mine owner is aware of the unusual risks which will be assumed by workmen who are selected to accomplish the hazardous task. Therefore, where a mine owner agrees to permit the accomplishment of unusually dangerous work, the employees who are injured in the performance of the duties assigned to them may fall back upon the owner of the mine for compensation for injuries received. Therefore, where the owner of a mine orders work to be done from which it might naturally be expected that workmen will be injured, he should exercise a high degree of care in an endeavor to prevent the injury being sustained by the employees. He cannot relieve himself of responsibility by entering into a contract with another person to perform the work and to assume the exclusive control of the men, as he can if the work to be done is of such character that no injury is likely to be effected if the work is properly done.

As was said at the beginning, persons who accept employment in a mine assume the risks ordinarily connected with the performance of such work, and an injured miner cannot recover damages from either the owner of the mine or the contractor where the injuries result from the natural consequences of the employment. In other words, a workman is expected to exercise ordinary care in preventing injury to himself, and if he is injured as a result of his own carelessness, no recovery may be obtained. The employer, however, must maintain the premises in good condition and furnish reasonably safe tools with which the employees may work. It has even been held that a mine owner is not liable for injuries sustained by a workman where a particular kind of work is extremely hazardous, under the circumstances that the injured man was aware of the dangers and, also, was experienced in the performance of the work. This, however, is not in accord with the ruling expressed in a preceding paragraph.

Employment of Inexperienced Workmen Is at Risk of Employer

Instances may be cited where employers have been held liable for damages where it was shown to the satisfaction of the court that the injured man was inexperienced in the work, and the employer failed to inform him of the dangers by which injury may be accomplished.

The amount of compensation which an employee may receive, when he proves to the satisfaction of the court that he deserves a verdict, may be determined by consideration of the seriousness of the injuries sustained, the expenditures which the injured person has had by way of doctor bills, nurses, and medicines; the pain endured; the time which he has lost; and the value of his services.

Automatic Regulation Pays

By W. F. Schaphorst

During the last ten years power plants have become almost automatic. I stepped into a comparatively small plant not long ago and there was nobody in the engine room; the chief was not at his desk in his office; and there was nobody in the boiler room. I then went into the back yard, and there was the entire force, including the chief, looking at and commenting upon the beauties of one of the most gorgeous rainbows I have ever seen. In this plant, while the operators were out the electrical end was "regulating itself"; the engine governor was taking care of the engine speed; the stokers were automatically firing the boilers; and boiler feed regulators were taking care of the feed water. Temporarily everything was O K and the force had nothing to worry about while admiring the rainbow.

Not only does automatic regulation make life more livable for the operators, but it is a good investment. Take boiler feed regulators alone, for example. An actual instance has just been brought to my attention where a concern saved nearly $10,000 per year by installing automatic boiler-feed regulators and reducing the number of men needed in the boiler room. It is said that the total investment was much less than $10,000, so much less that the investment paid over 200 per cent interest the first year. They have twenty-four boilers of over 500 hp. each. Besides, this $10,000 saving does not include the coal saving that accompanied the better regulation that resulted after automatics were put in. Automatic regulation generally pays.

Further Uses for Chromium

The hardness of metallic chromium is used to good advantage in making paper money, according to William Blum, in a recent issue of *Research Narratives.* The plates from which the bills are engraved by the U. S. Bureau of Engraving and Printing were formerly of case-hardened steel and yielded from 30,000 to 70,000 impressions. Then, five or six years ago, plates made by electrolytic deposition were developed, alternate layers of nickel and copper being deposited. But the nickel surface was not so hard as the case-hardened steel, so tests were made with chromium. As a result of the study, chromium plating is now used by the Bureau and has been eminently successful. The impressions are somewhat sharper than from the nickel or steel plates, and a layer of chromium only 0.0002 in. thick, deposited upon the nickel surface of an electrolytic printing plate, increases its useful life to at least four times that of a nickel surface and twice that of a case-hardened steel surface. As fewer plates are required, the currency is even more nearly uniform then formerly. The method is therefore in a double sense a "money-making process."

Chromium is now attracting the attention of many manufacturers. Its possibilities lie in (1) its great hardness and hence its suitability for printing plates, dies, gages, cams, and gears; (2) its high luster and resistance to tarnish, which render it useful for exposed reflectors; and (3) its resistance to atmospheric corrosion, which has led to its application, usually over nickel plating, on automobile radiator shells, bumper bars, plumbing fixtures, and other objects. Through the studies of chromium plating now in progress much wider application is expected.

Useful Operating Ideas

Mine Dewatering Diagram

By W. M. Hutton
3 London Wall Buildings, London, E. C. 2

Dewatering a flooded mine may be represented graphically on a time base to show the effect of varying rates of inflow and of varying rates of pumping, and the diagrams are particularly useful where these rates increase or decrease as the water is lowered. By "rate" is meant quantity per hour or other unit of time. The important factors are (a) total quantity in mine or "dead" water; (b) rate of inflow of new water as the water level is lowered; (c) capacity of the dewatering plant at various stages of the operation.

The accuracy of estimate of factor (a) will vary widely in different cases. Sometimes it will be little better than a guess based on what ore is believed to have been shipped from the mine plus the dumps found on the surface. On the other hand, where accurate plans of underground workings exist, the quantity of "dead" water can be closely estimated. Correct predetermination of factor (b) is of great importance. Though an underestimate of "dead" water would only entail an extension of the time necessary to dewater the mine, an underestimate of the inflow might protract the operation indefinitely and call for increased pumping plant and starting all over again.

Furthermore, a record of what the mine was finally "making" at a certain depth may not be a safe basis of estimate as to what is to be expected in dewatering it at a more rapid rate than that at which it was opened up originally. This point is important, although not always realized. Inflow is not necessarily the result of an underground spring of constant flow. It may be the result, partly at least, of pervious country draining into the workings as the mine opens up. This opening up may have extended over years, and the quantity to be handled divided over this period would represent a rate of flow much less than from water-logged country being rapidly drained a second time. Put in another way, if approximately the same total amount of inflowing water is to be handled in a shorter time, the rate of pumping must be proportionately increased. This consideration should be kept in mind in using previous records of inflow.

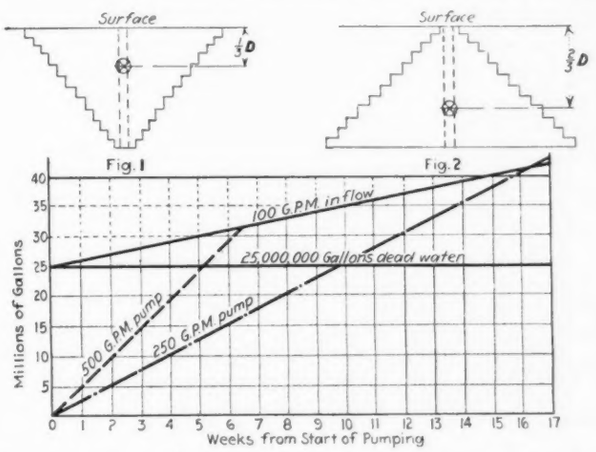


Fig. 1—Showing higher center of gravity when mine openings decrease with depth

Fig. 2—Showing lower center of gravity when mine workings widen in depth

Fig. 3 (Lower)—Diagram showing "dead" water augmented with constant influx

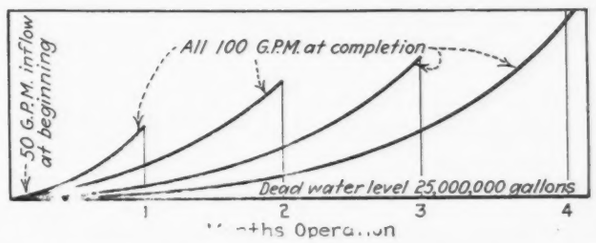


Fig. 4—Showing increased amount of water to be handled when inflow increases from 50 to 100 gal. per minute

The time factor (c) will be all-important in deciding the capacity of the dewatering plant. The shorter the time allowed the greater will be the plant capital cost but the less will be the operating cost as represented by wages and fuel. This is clearly indicated in Fig. 3, where the 500-gal. per minute pump is shown not only to have emptied the mine in half the time but also to have handled a considerably less *total* volume of water than the 250-gal. unit. The total power will, of course, be proportional to the total water raised. Ample capacity, then, is not only prudence, in view of the uncertainty of factors (a) and (b), but is in the direction of economy in total cost. The plant may be of a type which, granted continuous operation, will maintain a constant rate of delivery throughout the operation, or it may be of a type which, no matter how efficiently operated, will steadily fall in capacity as the water level falls. Constant-speed reciprocating pumps would be in

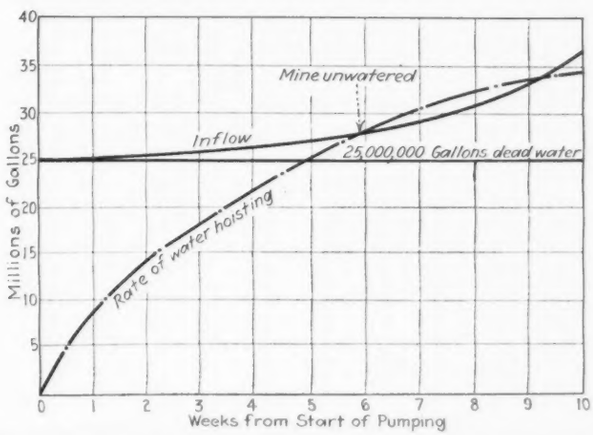


Fig. 5—Showing prolongation of pumping time when inflow increases and rate of dewatering decreases with depth

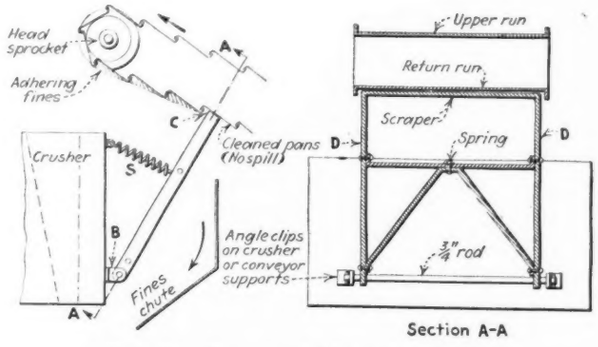
the first category; air lifts and hoisting by bailing skips would be in the second. It is obvious that at a fixed rope speed a bailing skip will raise nearly double the quantity per hour from 500-ft. depth as from 1,000 ft. The relative merits of these systems should be considered in conjunction with a diagram showing the distribution of the water in relation to depth. Figs. 1 and 2 illustrate different conditions. In Fig. 1 the average depth from which water is to be raised is only one-third of total depth. In Fig. 2 the average lift is two-thirds of total depth. The ratios correspond to the center of gravity of the figures represented.

For a case resembling Fig. 2, a plant which maintains its full capacity right to the bottom of the mine would be indicated, while bailing or air lifting would show to advantage in Fig. 1. These diagrams represent "dead" water only. Where a compound diagram is constructed to include inflow, the tendency will be towards the condition represented in Fig. 2. Fig. 3 shows the elementary case of a fixed quantity of "dead" water with an inflow of constant amount from the start superimposed upon it. It incorporates these various factors in such a way that the time taken in the operation is arrived at graphically, and alternative methods and rates of pumping can be directly compared. The mine is dewatered on the date where the pumping curve or line cuts the quantity line. Up to this point the conditions are so simple that diagrams should be unnecessary. If, however, as is more probable, the rate of inflow increases as lower depths are reached, the total quantity line will no longed be straight, but will be curved to a degree varying with the rate of pumping. In other words, if pumping capacity is such that the bottom is reached in a month, the maximum rate of inflow will also be reached on that date. On the other hand, if the operation takes six months the maximum inflow will also be delayed to that date. To be correct, then, a series of curves should be plotted, each representing rate of inflow for different times to empty the mine. Such curves plotted for one, two, three, and four months' operation are indicated on Fig. 4. As previously noted, the pumping line or curve on Fig. 3 is for an undiminished rate of delivery throughout, and, consequently, straight. Delivery by bailing skips will, however, be represented by a curved line as shown by Fig. 5, indicating how capacity falls off as the water level falls. The diagram corresponding to Figs. 1 and 2 would be used in plotting this curve. One great value of the diagram is that it indicates in a striking manner the joint effect of increasing inflow and decreasing pumping rate as the lower depths are reached. It is not too much to say that here lies the cause of many a failure and many a weary extension of the time necessary to unwater a mine.

Scraper for Beaded Pan Conveyor

By Jesse C. Stoddard
Dover, N. J.

Where beaded pan conveyors or feeders are used to feed crushers, it frequently happens that when the material is of a wet or sticky nature a considerable amount of the fines will stick to the return run of the feeder and cause a troublesome accumulation of the material beneath the feeder, which requires periodic cleaning up by manual means. The scraper shown in the accompanying drawing has been used successfully in one plant to correct this condition, and it can be quickly and easily constructed and installed by an ordinary mechanic.



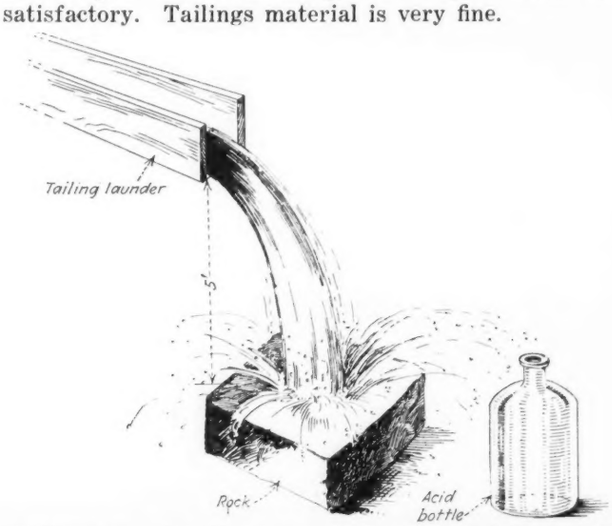
Details of scraper for pan conveyor

For a feeder four feet wide the scraper is constructed of one piece of 3-in. by ¼-in. iron bent as shown in section *A-A* and is hinged at points *B* so that the scraping edge *C* cleans off each pan as it comes around. The spring *S* causes the scraping edge to bear firmly against the pans and to cut all adhering material loose so that it falls into a bypass chute and thence to the crusher discharge. It will be noted that the side arms *D* cause the scraper to snap from one pan to the next and at the same time prevent the scraping edge from becoming caught in the return run of the feeder or in the depressions between the pans. The arrangement should be mounted so that the horizontal part which does the scraping is parallel to the face of the individual pans, so that no material may become caked in the depressions between the pans.

Tailings Sampler

By Cooper Shapley
Bishop, Inyo County, Calif.

To avoid the use of a mechanical sampler on the tailings launder at the mill of the Tungsten Products Co. near Bishop, Calif., a simple device was thrown together and tried out. The tailings discharge is on a hillside, and the tailings drop from the end of the launder a distance of five feet. A flat rock was placed so as to take the full flow of the falling stream. An acid bottle was placed at such a distance that it would be filled in twenty-four hours. This distance was determined after a few trials. The results obtained from the samples thus obtained proved very uniform and satisfactory. Tailings material is very fine.



Tailings sampler, Tungsten Products Co., Bishop, Calif.

Discussion

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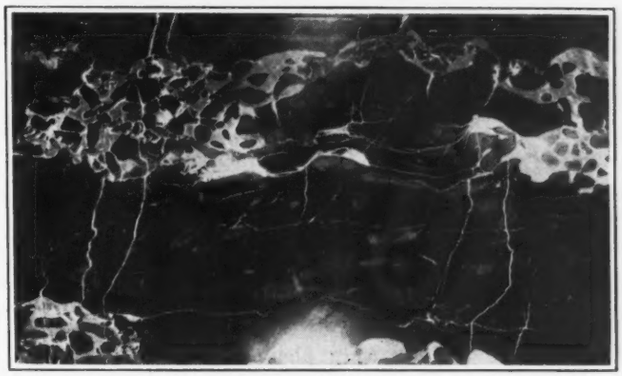
Angular Inclusions and Banded and "Orbicular" Structure in Ore Veins

THE EDITOR:

Sir—The problem of angular fragments of rock, in connection with banded structure and successive rings in veins (Ringelerz), is well worth studying, as in many cases it may give an indication to the genesis of the ore in question. It is Mr. Spurr's merit to have called special attention to it in his "Ore Magmas" and in several articles. I had occasion to study such structures during the last ten years in fissure-veins of lead ores, iron-carbonate and iron-carbonate-copper ores in Spain. My notes on their origin do not point quite to the same conclusion as that of Mr. Spurr. I was somewhat surprised that metasomatic replacement was so easily excluded in his article in the *Engineering and Mining Journal* of Sept. 25 last. For we read there, after a description of the successive rings around the fragments of rock: "The suspicion that these fragments may be residua of replacement is thus excluded." Indeed, they should not be considered as the remnants of bigger blocks or of solid rock, partially replaced. Yet there is evidence of replacement—replacement not of the blocks themselves, but of the groundmass in which they were bedded, a groundmass that was, that existed at the time when the fissure was formed. The fragments were not suspended, but were rather tightly inclosed.

Arguments brought forward in favor of the supposed suspension are: Either the solution must have been so highly concentrated that it had a higher specific gravity than the fragments (in which case these should float to the upper regions of the ore deposit), or the solution must have been in a physical condition which gave it supporting power (a physical condition not obeying any known laws of physics). These arguments do not seem convincing. Should there not have been a movement, either upward or downward, slow though it may have been, in a fluid mass? Yet there is ample proof that in most if not all cases the fragments did not move. The article cited above gives a strong one, where the case is illustrated of later rings that cemented such fragments to the wall as lay closest to it.

My observations lead me to the conclusion that the fragments never were suspended in a fluid ore magma. Every fault fissure is wholly or partially filled with a crush-breccia, consisting of angular fragments of all sizes, diversely oriented as to stratification in the case of sedimentary wall rocks; irregularly mixed when the walls consist of different rocks. But all these fragments are surrounded by a mass of finely ground material. Now, it is well known that the finer a substance is ground, the easier and sooner will it be dissolved and attacked by chemical solutions, while coarser fragments may remain unchanged for a long time. It is this finely ground matter that has been easily replaced by ore and vein matter of the ore solutions in fissures, while the coarser fragments were not attacked, especially when the ore solutions were weak. They may have been even protected by the first ring or shell of ore which was



"Marble" panel in smoking room of S. S. "Venezuela," Royal West Indian Mail

deposited. Shoots of ore with many angular fragments represent, then, such a mass of crushed material in a partially open fissure. I found them in one case in an iron-manganese-carbonate vein in Berástegui, in the Province of Guipuzcoa (Spain), up to a width of 10 meters, sometimes surrounded on all sides by clean ore. They made the ore suddenly unworkable and were left as pillars to support the walls.

If such veins show banded and orbicular structure, it means that the percolating solutions began their replacement on the walls and on the fragments, due to difference in permeability. This difference is an important factor in ore deposition, specially in metasomatic replacements. In fact, I observed that in some instances a polished, striated surface (slickenside) in the fragments or on the walls had increased ore deposition, being a less permeable surface.

The photographs and explanatory drawings in Mr. Spurr's article are very instructive indeed, specially with respect to "spalling" of some fragments during the formation of rings, and the missing of rings of early periods. This, however, can be explained also in the way mentioned above. We should remember that many of the fragments must have been cracked from the beginning, though not sufficiently to split. These cracks may become filled by the first minerals deposited or they remain closed till the pressure of the walls or later small movements in the fault zone make them wider or make them split. This is quite possible, as the mass of crushed rock is a rather loose material until the fine sand is completely replaced and becomes rigid. In this way, the fragments may become so full of small veinlets of ore that they are sometimes almost entirely replaced too.

Vugs and honeycomb structure of the last mineral deposited indicate open spaces in the original breccia,

or difference in volume of the replaced and the replacing minerals. It is a quite common feature, for example, in replaced limestones.

It was interesting to note that Mr. Spurr called also attention to the "grand antique" marble from France. Indeed, the different kinds of marble furnish a field for studying these phenomena almost as vast as our ore veins. A marble called "vert antique" from Belgium is even more instructive. I keep a slab of it in my collection. In a finely crystalline groundmass of light green marble it contains fragments of pink, dark green, gray, and black marble. The latter has a slaty appearance, clearly stratified. These fragments show all sharp angles. The black pieces, especially, are often cracked; and along the cracks and some stratification planes they are more or less replaced by the light-green marble. Besides the inclusions mentioned there are also fewer pieces of pure white marble. These show always a green rim, apparently of fibrous matter, but they have no sharp edges. The origin seems to me as follows: Marble beds of different composition have been cracked and crushed in a fault zone. The groundmass of finest crushed matter was replaced or recrystallized by subsequent calcareous solutions; the angular fragments of slaty limestone only partly so, along cracks and better soluble layers; the pieces of white marble, being purer and more homogeneous, lost their sharp angles and were replaced only to a certain distance inward. I am trying to find out something about the geology of this marble and the place where it is mined. The accompanying photo shows yet another marble, showing pieces of black marble with gray spots, surrounded by a light red groundmass. There are sharp angular and rounded fragments. Here replacement of the fragments themselves is quite clear. I took the photo in the smoking room of a West Indian steamer two years ago, when traveling to Curacao. I could not find out where it comes from.

Angular inclusions in ore veins are no proof for injected magmas. In a certain limited class of veins closely related to pegmatite dikes they may be so. In such cases they have been taken along and forced upward by the injected mass. In most cases, however, they represent the non-replaced part of a mass of crush-breccia in a fault fissure that may have remained partly opened. The finely crushed groundmass between the coarser fragments has been replaced. Orbicular and banded structure may occur according to the nature of the replacing ore solutions and the changements thereof as regards temperature, concentration, and capacity to replace the primary matter, formed by the wall rock.

J. C. SCHAGEN VAN SOELEN..

Apeldoorn, Holland.

Use of Symbols in Flow Sheets

THE EDITOR:

Sir—I notice in your issue of Oct. 16 on page 608 that you run an illustration entitled "Symbols for Mill Flow Sheets," and in the footnote to the illustration you state: "The symbols shown above have been devised for the use of the artists in the drafting room of the *Engineering and Mining Journal*," the inference being that these symbols are novel and that the idea is of recent date.

I am inclosing blueprints from tracings of two flow sheets originating in this office. No. 1 was made in the early part of 1908 and No. 2 was made in March, 1926. Between these dates we have used in connection with our test work and mill designing several hundred similar flow sheets.

The idea of using symbols on flow sheets having some likeness to the machines they represent was originated by J. M. Callow previous to 1906 and before he incorporated the General Engineering Co., of which company he is the president.

Some years ago we had rubber stamps made, the impressions from which were used to illustrate the machines on the flow sheets. Later we abandoned the rubber-stamp idea as being rather cumbersome and unhandy.

ERNEST GAYFORD.
Secretary, General Engineering Co.
Salt Lake City, Utah.

The flow sheets accompanying the letter are omitted because of lack of space. No claim for originality of the symbols published in the issue of Oct. 16 was intended. The novelty consists merely in the method pursued to simplify the work. The draftsmen are not acquainted with the specialized equipment used in mills and concentrators, and this plan enables the editor to take any flow sheet and to make an intelligible outline for the draftsman with a minimum of time. The actual work of the draftsman likewise is lessened by the use of the large prints for tracing.—EDITOR.

Magmas and Ore Magmas

THE EDITOR:

Sir—I have always read with interest the writings of both Lindgren and Spurr, and I was particularly interested in the carefully formulated working hypothesis put forward by Spurr in his treatise on the source and cause of ore deposits entitled "The Ore Magmas." In fact, I wrote a popular review of the subject for the *Post*, of New York. My interest in the subject is my apology, if one be needed for joining in the discussion to the extent here indicated.

First as to terms: there seem to be several geologists who object to the use of the term "magma" as applied by Spurr to "ore magma," and while my own experience and observation lead me to concur with the major portion of Spurr's dicta, I think the choice of the term "ore magma" was unfortunate; we needed and need an entirely new word for the varied and mixed materials that enter into an orebody while still in the "formative" process.

A "magma," as I understand it, is that great mass of molten or partly molten material, that may vary in consistency from plastic to liquid, that forms at a given moment a "plutonic zone" in abyssal depths below the earth's surface.

I take it that a magma has a cause, a beginning—we may even say a birth, a life, and a death; after its demise it becomes merely a batholith, a fit subject for articles on its surrounding geologic complex by the average run-of-mine geologist.

I take for granted that the part is always less than the whole, and that while all kings are supposed to be men, all men are not necessarily kings.

The "magma" during its most vigorous phase of life probably connects by pipes and major fractures in the overlying earth's crustal blanket, with various active volcanoes; at this and later phases it exudes dikes, laccoliths, and all the phenomena of intrusive and extrusive processes, and finally, and generally after the differentiation process within the body of the magma proper

has been going on for a vast period, we get a special type of minor intrusive processes (mark never extrusive), with the phenomena of ore deposition; subject to the pet term "during the period of expiring vulcanism." By this time the magma is much reduced and has lost a considerable part of its volume, and the "residual" magma cools and becomes a mere batholith.

Are we to apply the term "magma" to the "part" or only to the phenomena as a whole? If to all the parts as indicating their source, we would have: Volcanic magma, lava magma, dike magma, laccolith magma, chonolith magma, vein magma, ore magma. Note that all veins are not "ore."

It seems to me therefore that although the term "ore magma" can be understood, and is simple and euphonic, it is not strictly correct on a philological basis. Not being sufficiently erudite, I leave the possible coining of a better term to others. I think a term should be coined and the word "magma" reserved for "the plutonic zone" as a *whole* while still "active."

Now, a word as to the "magma" and its containing walls:

We really know nothing with any certainty as to why certain large areas in abyssal depths of the lithosphere become sufficiently heated to form a "magma zone." We do not know if the central parts of the earth are extremely heated, possibly to the point of being either plastic or liquid, with a mere outer shell of relatively rigid material; or whether the alternative hypothesis is more correct—viz., that the central core is solid and with a rigidity approaching that of steel. If this is the case, then any given magma must develop somewhere below the zone of fracture, presumably in what a structural geologist might term the "lower zone of flowage"; and in that event it would have a base or "hearth" floor at or about the juncture between the limits of the zone of flowage and the "rigid" surface of the interior.

It must be admitted the data obtainable from batholith (i.e., cold, dead magmas) as exposed by erosional agencies have generally shown contact phenomena indicative of intrusion from even greater abyssal depths; we have no actual evidence of local fusion from relatively local causes; but then we have so far had opportunity to study only the "domes" of magmas, never their bases (?) or basal parts (?).

If a magma does represent a relatively locally developed liquefaction of a zone of the lithosphere, having within its early stages a true floor or hearth, and limiting zonal walls (?), then we have to consider the probable corelative phenomena of a gigantic smelting furnace without an air blast, but with ultimate differentiation due to gravity as well as to gaseous tension. In this case some very interesting hypotheses may be developed as to other corelative causes affecting metallographic provinces; and also zonal source, distribution, and deposition of ores, of a given metal.

The above, however, is a mere suggestion indicating a line of constructive if rather hypothetical reasoning, and forms a subject too extensive for a letter, but I feel certain that more effort must be given to corelating astrophysical and geodynamic phenomena, as affecting the real and basal causes that create a magma, before we can build up sound interpretations regarding the phenomena of the magma byproducts; for, after all, "ore" is a mere incident in the greater scheme.

San Francisco, Calif. JOHN M. NICOL.

California State Corporation Department Protests

THE EDITOR:

Sir—In your issue of Oct. 23, 1926, we note that you published a letter subscribed by Stephen Chaplin, of Keeler, Calif., making serious misrepresentations, shown by the facts as disclosed by the records of the department concerning the application of the F. W. C. Manufacturing Co., Inc., of which said individual appears as vice-president and director, as well as inventor of a secret formula for compounding of a nonpoisonous and safe blasting powder proposed to be manufactured somewhere in the vicinity of Los Angeles, this state.

On July 29, an application was received from Hitchcock Financing Service, of Los Angeles, with a letter of transmittal, requesting that they be advised as to the amount of the filing fee due. On Aug. 2 a letter was addressed to said concern, properly advising them as to the amount of said fee and indicating that applications cannot be considered as filed unless and until the fee shall have first been paid. No reply was received to this communication, and on Aug. 18 they were again addressed in connection with the same matter. On Sept. 1 the filing fee was received at the Los Angeles office from the above-named individual, his letter of transmittal giving date of Aug. 29. On Sept. 4 a verification blank was forwarded to the attorneys representing the company, which was not executed and returned until Sept. 13. On Sept. 23 the permit was mailed to the company's attorneys.

While it is not the practice of the department to indulge in futile arguments, the facts in the case of Mr. Chaplin and his company are not as represented by him. CLIFFORD J. MACMILLAN,

Sacramento, Calif. Commissioner of Corporations.

Sitting on Top of the World

THE EDITOR:

Sir—I read the editorial about the article, "The Prospector," in the *Engineering and Mining Journal* of Oct. 16, 1926, page 601. I wish I knew as much about prospectors as that guy in the "popular-intellectual magazine." He thinks all prospectors are bums. I don't know the taste of whiskey or tobacco. I was born and raised in the Siskiyou Mountains, and worked in the mines, and prospected all my life, and am sixty-five years old.

I never went to school—there was no sort of school up there when I was a boy. I work for myself and live in my own log cabin, and I will bet that the fellow who wrote that article works for wages and pays rent to a landlord. I go to town only when I need grub. There is plenty of game and trout where my claim is. Last spring and summer while the snow water lasted I cleaned up $125 in gold, $30 in platinum, and three small diamonds, one weighing a carat, one of one and one-half carats, and a stone weighing two and one-half carats. One was canary yellow and two were blue white. I got $125 for the diamonds. Besides I trapped two marten, twelve mink, and one black bear pelt. I am waiting for the fall and winter rain. This morning, Friday, Oct. 22d, we had two earthquake shocks, at 5 o'clock and 6 o'clock. The 6 o'clock shock lasted about six seconds. STANLEY MORGAN.

San Francisco.

Consultation

Metallurgical Calculations

"Can you give me the solution of the following problems or recommend some handbooks where such information can be obtained?

(1) The mill feed assay is 3.3 per cent lead and 5.6 per cent zinc. Lead concentrate, 70.9 per cent lead and 1.3 per cent zinc. Zinc concentrate, 52.5 per cent zinc and 1.2 per cent lead. Final mill tailing, 0.3 per cent lead and 0.25 per cent zinc. What is the total recovery? Are there any standard formulas that can be applied to such a problem?

(2) A total of 900 c.c. of mill pulp weighs 38 oz. What is the percentage of solids? I would like to figure out a table for the different feed and discharge solids (pulp density chart).

(3) If I find that a certain reagent, properly mixed or diluted, gives best results at sp.gr. 1.065, and 0.5 lb. to the ton of ore feed, how can I find the number of c.c. to use per minute when milling 100 tons per eight hours? I would like to make a table for the reagent operator like: 0.5 lb. per ton = (?) c.c. per minute; 0.6 lb. per ton = (?) c.c. per minute, etc."

In solving the first problem let

100 = weight of feed assaying a per cent lead and b per cent zinc;

x = weight of lead concentrate assaying c per cent lead and d per cent zinc;

y = weight of zinc concentrate assaying e per cent lead and f per cent zinc;

z = weight of tailing assaying g per cent lead and h per cent zinc.

Substituting in the following formulas:

$$x = \frac{100(a-g) + y(g-e)}{c-g}$$

$$y = \frac{100(b-h) + x(h-d)}{f-h}$$

there is obtained

$$x = \frac{100(3.3-0.3) + y(0.3-1.2)}{70.9-0.3}$$

$$y = \frac{100(5.6-0.25) + x(0.25-1.3)}{52.5-0.25}$$

Solving,

x = 4.1198 = weight of lead concentrate

y = 10.1564 = weight of zinc concentrate

z = 85.7238 = weight of tailing, by difference.

Then, by simple multiplication, 100 parts of feed will give

	Feed	Lead Concentrate	Zinc Concentrate	Tailing
Lead	3.3	2.9209	0.1219	0.2572
Zinc	5.6	0.0536	5.3321	0.2143

Or, in percentages,

Lead	100	88.5	3.7	7.8
Zinc	100	1.0	95.2	3.8

In other words, 88.5 per cent of the lead is recovered in the lead concentrate and 3.7 per cent in the zinc concentrate, a total of 92.2 per cent; 95.2 per cent of the zinc is recovered in the zinc concentrate and 1.0 per cent in the lead concentrate, or a total of 96.2 per cent.

In attacking problem (2), 38 oz. should be multiplied by 28.3 to reduce it to grams. This would give 1,077 g. as the weight of the 900 c.c. of pulp, and the specific gravity would then be 1,077 ÷ 900, or 1.196. The percentage of solids cannot be determined, however, as the specific gravity of the ore is not given. A convenient method of determining this, approximately, is to weigh out about 50 grams of the ore and add it to a graduated 150-c.c. cylinder that has been previously filled with exactly 100 c.c. of water. Note the increase in water level, in c.c. Divide this into the weight of the ore added, and the quotient will be the specific gravity of the ore. This method was described in the Oct. 2 issue of *E. & M. J.*

As to problem (3), it is also impossible to answer without a knowledge of the specific gravity of the reagent. Under the conditions stated, 47 grams of the reagent should be added per minute, but it is impossible to say how much of the reagent would be present in a solution of 1.065 specific gravity without more data.

In the appendix of "A Textbook of Ore Dressing," by Richards and Locke, are several helpful formulas.

Colloidal Fuel

"I shall be much obliged if you could give me some information on 'colloidal fuel.' I believe a man named Linden Bates did some work in this connection with a United States submarine, and also in London for the Mineral Separation, Ltd."

Practically all the work on colloidal fuel was undertaken, we believe, by Lindon Bates, as you intimate. It was his idea that a large amount of bunker space could be saved on vessels by using this fuel, which consisted in finely powdered coal held in suspension in fuel oil, with the aid of some organic reagent that prevented its settling. It was possible to suspend quite a large amount of the coal in the oil without adding perceptibly to the volume of the latter, and thus a large number of heat units were added to the fuel without increasing the space required to store it. It is our impression that Mr. Bates is the only one that has taken any particular interest in this matter.

Titanium Minerals

"Will you please answer the following questions in your consultation column?

For what purposes, and where, are "titaniferous magnetites" used?

For what purposes and where is the mineral "ilmenite" used?

What percentage of titanium oxide is contained in the ilmenite that is sold in the American market?"

Iron ores with a high titanium content are found in New York, New Jersey, and elsewhere, but they have not been exploited for the reason that titanium has made the beneficiation impracticable.

Ilmenite is used largely for manufacturing white titanium oxide for paint, carbon-free ferro-titanium, and ferro-carbon-titanium.

Ilmenite concentrates of high grade containing 52 per cent titanium oxide (TiO_2), are available at from $12 to $15 per ton f.o.b. north Atlantic ports. A lower-grade product from mines in Quebec is imported in the form of lump ore. It is said to assay about 35 per cent titanium oxide and to sell at a lower price than the high-grade concentrate.

News of the Week

The Mining News given in ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Summary

TESTIMONY in Clark-Anaconda apex suit all in; briefs to be filed; judge's decision expected in January—Leonard mine closed temporarily.

Phelps Dodge Corporation plans lead smelter at Douglas, and extensive underground development at Bisbee, Ariz.

Idaho lead freight rate pending before Interstate Commerce Commission—Research work progressing at Houghton.

Los Angeles capital entering British Columbia mining industry; prospectors active.

Aluminum production increasing in Germany; European cartel in process of formation.

Mexican silver mines lay off employees due to low price of white metal; cost of production about 56c. per ounce; only high-grade mines can survive.

Colorado feldspar and fluorspar shipped to Eastern markets — Boulder Tungsten increases production — Golden Cycle increases dividend.

Michigan mine disaster kills 51 men—Copper miners return from industrial centers.

U. S. antimony production 33 tons in 1925 — Utah mine production exceeding 1925 yield.

Optimism prevails in London tin market.

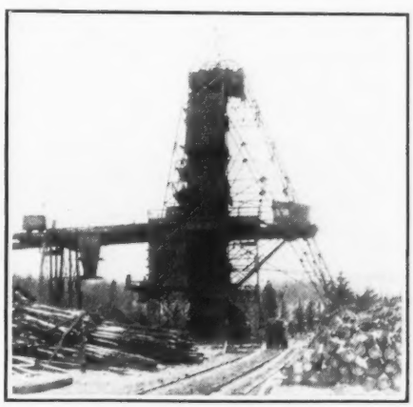
The Barnes-Hecker Mine Disaster

Cave-in Causes Death of Fifty-one Men, Including County Mine Inspector—Shaft Seriously Damaged and All Workings Filled with Water

THE LAKE SUPERIOR mining region experienced its greatest mine disaster at noon on Wednesday, Nov. 3, when fifty-one men lost their lives in the Barnes-Hecker iron mine of the Cleveland-Cliffs Iron Co., near Ishpeming, Mich. Without warning, a large block of ground broke loose, causing a cave through to the surface, and within fifteen minutes the mine was filled with quicksand and water. Only one man escaped alive. On Wednesday night seven bodies were removed from the tunnel which connects with the Morris-Lloyd mine, about a mile away. It will be some time before any additional bodies can be reached, as the Barnes-Hecker shaft is wrecked and must be cleared of débris and great quantities of sand. The cave at the surface is about 300 by 250 ft. and now holds considerable water, which is being lowered by pumps. While this water remains there is danger to men employed in the rescue work, and the work must be carried on very cautiously.

The Barnes-Hecker mine has three levels at depths of 600, 800, and 1,000 ft. The 1,000 level is connected with the 1,200 level of the Morris-Lloyd mine by a raise from the latter 186 ft. long at a point 1,600 ft. to the east of the Barnes-Hecker shaft. The bodies that were removed on Wednesday night were found in the Morris-Lloyd mine, about 1,000 ft. from the raise. These men had endeavored to escape by that route, but were overtaken by the mud. The raise from the Morris-Lloyd mine is believed to be plugged, as practically no water reached the latter workings. Three bulkheads have been constructed on this level to prevent water from coming in in case of another run of sand and water. There is the possibility that the ground is moving to some extent. The water, which raised in the shaft from the sump to within 185 ft. of the collar, has receded to a point believed to be near the first level station. The forty-four bodies remaining in the mine are on the second and first levels and in the subs, some distance from the shaft.

More than 450 ft. of overburden gave way when the ground broke through. Mining had been carried on above the 600 level to a point 150 ft. above. Some ore was left there and on top was a timber mat, 250 feet of jasper ledge and 200 ft. of sand and gravel overburden. What caused the ground to give way is a mystery, but it is possible that the jasper ledge (cap rock) hung up as the back was being brought down and finally let go with terrific force. No doubt some of the men were killed by the rush of air, which wrecked the electric lines and the pipe lines.



Barnes-Hecker mine shaft near Ishpeming, Mich.

The one man who escaped was a motorman on the second level. He was back in the level about 200 ft. from the shaft when he heard the first rumblings and he lost no time in reaching the ladders of the shaft. He climbed through to surface. Companions who were close behind him in the shaft were overtaken by the sand. Included in the list of dead are Captain William Tippett, mining captain at the mine since the shaft was first started, in 1918, and William E. Hill, mine inspector for Marquette County. The day previous he had been re-elected to serve another two-year term.

Other Mine Disasters

The previous high record for number of men killed in a Lake Superior mine was forty-one, that number being drowned in the Milford mine, on the Cuyuna range, Minn., a few years ago. About thirty years ago twenty-eight men were caught in the Mansfield mine, on the Menominee range, Mich., and at that time one miner escaped by climbing to surface.

The Barnes-Hecker mine was at one time a very wet property, the pumps handling 5,000 gal. per minute. Of late the pumps have been taking care of only 700 gal. North Lake, which was to the east, was drained and pumped out in order that there would be no likelihood of water getting into the workings from that source. The entire area had been well dried up and only some surface water and a few underground water-courses remained for the pumps.

Forty of the fifty-one men were married, some having large families. Com-

pensation will be paid by the company, which carries its own risks, in all cases of dependents or partial dependents.

Many mining men are at Ishpeming and are participating in daily conferences at the office of the Cleveland-Cliffs Iron Co.

STATEMENT BY SUPERINTENDENT ELLIOTT

S. R. Elliott, general superintendent for the Cleveland-Cliffs Iron Co., gave out the following statement regarding the accident:

"At about 11:20 a.m. Wednesday, Nov. 3, a cave occurred at a point above the first level, Barnes-Hecker mine, and in a period of about fifteen minutes the workings of the entire mine were filled with sand and water. The sand and water rose in the shaft to a point about 185 ft. from the surface.

"In October, 1923, mining was commenced on a narrow lens at a point 250 ft. below the ledge, above which was 200 ft. of overburden. The orebody which was being sliced out was approximately 60 ft. wide and 225 ft. long, which is an unusually small one. After the first sublevel was mined, the open space was completely filled with timber. The succeeding sublevels were mined by the slicing method, the vertical interval between slices being only 11 ft. As the ore was mined in each of the twelve succeeding sublevels, each floor was completely lagged and cross-lagged with poles and lagging before the sublevel was blasted down. There was, as a result of this work, at least 50 ft. of timber closely matted together above the first level, which is 600 ft. below the surface. It is impossible to understand how any cave could break through a matting of such great thickness.

"Shortly before the noon hour, when all men come to the surface, without the slightest warning a cave occurred, causing a hole to run up from the mined area to the surface, and within fifteen minutes the entire mine and shaft were filled. Ordinarily, caves of this character give ample warning, either by increasing pressure on supporting timbers, or by a marked increase in the flow of water, due to cracks extending through the ledge. Nothing of this character had occurred in the mine. There are three levels in the mine, all of which are connected with numerous raises, making exit from the Barnes-Hecker mine through the second outlet, which is by means of a raise and drift, to the Morris shaft. It is evident that the captain, the county mine inspector (who was making his regular monthly inspection) and five other men were in the act of climbing down this connecting raise when they were overtaken by the rush of sand and water. Their bodies were recovered in the main drift leading to the Morris shaft.

"Due to the fact that the Barnes-Hecker mine is completely filled with sand and water it is impossible to estimate when the bodies of those men still in the mine can be recovered. Every effort is being made to reach and recover these bodies, but the task is a gigantic one.

"Crews have been organized at the Barnes-Hecker under the leadership of the most experienced men in the company's employ to do what repair work is permissible with safety under the conditions as they exist in the shaft. Below a depth of 375 ft. the shaft was stripped by the rush of sand and water. Work in such a restricted space, which must be limited to small crews, is bound to progress slowly. The water and sand have receded to a point between 400 and 500 ft. below the collar of the shaft. Above the latter elevation is a mass of broken timber which cannot be removed until the cage and skip roads have been rebuilt.

"As was expected, the water in the surface cave has risen to within a point approximately 20 ft. from surface (see photograph). Crews are now putting into commission the necessary pumps to lower this water as rapidly as possible.

"At a conference of the leading mining operators of the county today, it was the consensus of opinion that the methods now being employed are the only ones that could be followed with safety, and further that since the workings of the mine are filled with sand, there is no possibility that any of the men could be alive. This fact, however, will not retard the strenuous efforts now being exerted by the company in the work of recovery.

"Naturally the officials of the company keenly regret the occurrence of this tremendous catastrophe which has brought sorrow to so many of the families of its employees."

Caved area (300x250 ft.) about one-quarter mile from Barnes-Hecker shaft

Note: The broken ground can be seen in the background. The water now stands only 20 ft. below the surface of the ground. Trees are partly submerged.

SPECIAL COMMITTEE REPORTS

On Friday, Nov. 5, 24 mine executives from various points of the Lake Superior district gathered at the office of the Cleveland-Cliffs Iron Co., in Ishpeming, and went over every phase of the disaster. A careful study was made of the mining work at the mine since the property was first opened, and a committee of twelve visited the mine to look over the surface conditions. At the close of the meeting the following statement was issued:

"The Barnes-Hecker mine was visited and the conditions on the surface were inspected. It was found that that part of North Lake that could have affected the Barnes-Hecker mine had been drained and all surface drainage led away from the mining area by extensive ditching. The maps of the underground workings were carefully examined and the history of the property and its operation from the beginning to the present time was given consideration. From this inspection and study it is our judgment that the mine was operated according to the best mining practice and that all care possible was taken by the mining company to safeguard its employees and that

the accident was due to causes that could not have been foreseen.

"It is the opinion of the committee that every man in the mine was buried and met death almost immediately and that rescue work was impossible as the mine workings were completely filled with water, sand and mud in a few minutes. The work undertaken by the Cleveland-Cliffs Iron Co. to recover the bodies has been everything that could have been done and the methods adopted were the only means possible.

"In the prosecution of this work it may be necessary to excavate and keep free from water the surface in and around the caved area. As the overburden is very deep it will involve moving a large amount of earth and other material.

"In conclusion, it is the opinion of this committee that the recovery work will require a considerable length of time."

Work in the shaft is progressing more favorably than was expected and upon close investigation it has been found that the removal of broken timber will not be as difficult as first thought. It is now reasonably sure that a depth of 500 ft. can be reached soon. If no serious complications arise and the cage can be sent to the first level, 600 ft. deep, future progress can be estimated with greater accuracy.

Bevis Divide Takes Over Arizona Premier's Banner Vein

Arrangements have been made whereby the Bevis Divide Mining Co., a Nevada corporation, will take over a controlling interest in the Arizona-Premier Mining Co. The Arizona-Premier, which is a close corporation, controlled by Woods and Campbell, has been operating on the other end of the Banner vein at Stockton Hill from that under option to the Comstock Silver Mining Co. Conditions are similar, and the character of the ore in both properties is much alike. Both properties are approximately 12 miles northeast of Kingman, and both have been shipping ore for the last year. Frank Manson, Reno, Nev., is president of both the Comstock Silver and the Bevis Divide, and E. E. Campbell, formerly with the Arizona-Premier, is vice-president of the Bevis Divide.

Hillside District Busy

Reports received from the Cowboy mine, 24 miles west of Hillside, Ariz., and close to the Bagdad property, state that development is progressing at a satisfactory rate and that ore shipments will begin in a comparatively short time. The shaft is now 175 ft. deep and a drift has been started on the 100 level. The ore contains gold-silver-lead minerals.

Steady shipments are going out from the World Development Co., formerly the Copper King, which is three miles to the west of the Cowboy. Progress at the mine has been slow on account of a heavy flow of water which was encountered below the 150 level, but new pumping machinery is being installed, and it is the plan to push sinking as soon as the shaft can be kept dry.

Miners Return from Industrial Centers

Calumet & Hecla Consolidated reports the return of a number of men each week from industrial centers, and other mines in the Michigan copper district also are gaining underground workers with the coming of colder weather.

At Calumet & Hecla proper, at Calumet, Mich., a raise is being driven from the slope shaft of the Red Jacket branch to the bottom of the old Tamarack Junior shaft for ventilation. This will facilitate operations in the Tamarack Junior tract, which is yielding rich rock, values persisting at lepth and on the strike of the vein. At the Hecla branch, No. 7 shaft is opening favorable ground in the deepest levels, in the 90's. Nos. 6 and 9 shafts of this branch also are large producers.

Antimony Production 123 Tons in 1925

IN 1925 domestic mines produced 123 short tons of crude antimony ores, containing 33 tons of metallic antimony, according to the U. S. Bureau of Mines. Some shipments were also made from accumulated stocks of ore mined in Nevada in 1917 and 1918. One smelter in the United States reported a small production of metallic antimony from foreign ore.

The general imports of antimony metal or regulus during 1925 amounted to 10,659 short tons, valued at $2,513,420. This represents an increase in quantity of 3,383 short tons and in value of $1,612,502, as compared with 1924 importations. Approximately three fourths of these importations were from China, with the bulk of the remainder from Germany and the United Kingdom.

Colorado Mining Notes

The Falcon Lead Mining Co., with offices at Rico, Colo., is sending more than 100 tons of ore to the mill daily. One of the lower levels of the Falcon mine near Newman Hill just outside of Rico disclosed a new orebody which is in an altogether different channel. Operations are curtailed to some extent due to a shortage of skilled mining labor.

At Breckenridge, Colo., the Royal Tiger Mines Co. has recently added to its holdings and is said now to own the largest acreage of lode mines and placers of any mining company operating in Colorado.

The Blue River Gold Dredging Co., Breckenridge, Colo., is steadily at work dredging through rich bedrock placer deposits in the bed of the Blue River about two miles north of Breckenridge. The boat which was burned somewhat over a year ago has been rebuilt and is in good running order.

At Salida, Colo., the Metals Extraction Corporation smelter was recently started and is operating at full capacity, using the Gordon process. Some gratifying results have been reported with regard to the efficiency of the smelter.

Low-Cost Tunnel Driving

George Austin, of Spokane, manager of the Rainbow Mining & Milling Co., claims the record for the low cost of driving a tunnel. The property is in the Coeur d'Alenes, about three miles west of Wallace and just west of the Galena mine.

"The tunnel is being driven under contract," said Mr. Austin. "Back 1,500 ft. it cost $7.50 a foot, and next 500 ft. cost $8 a foot. The tunnel now is in 2,700 ft., and on the present 500 ft. the contractor receives $10."

Golden Cycle Increases Dividend Rate

The Golden Cycle Mining & Reduction Co., of Colorado Springs, Colo., has announced a dividend increase of 1c. quarterly. The increased dividend raises the quarterly payment from $45,000 to $60,000 and is regarded as significant of the future outlook in the Cripple Creek district as well as in the lignite mines operated by the Pikes Peak Fuel Co.

Colorado Feldspar and Fluorspar Find Eastern Market

Under a contract from Missouri valley ceramic plants, E. W. Lehman, Jamestown, Colo., is shipping 500 tons of Colorado feldspar monthly. The contract calls for 6,000 tons annually for a period of ten years. The principal source of supply is Jamestown, in Boulder County. It is being mined by open cut from a ledge which is 28 ft. wide and which outcrops for 3,000 ft. along a mountain slope. Five trucks are engaged in hauling it 16 miles to Boulder.

The remainder of the mineral is secured from near Golden. Shipments from both points are milled at Denver. After being crushed, the feldspar is put through a pebble mill, being reduced to the consistency of flour. It is conveyed by air current to storage bins, from which it is loaded for shipment east in paper-lined box cars.

The same operator is shipping 150 tons of fluorspar monthly from the Bluejay mine, at Jamestown. It is being used as a flux in Eastern steel plants. The Colorado Fuel & Iron Co., which formerly used Boulder County fluorspar in its Pueblo steel plant, has now developed its own mines near Wagon Wheel Gap, Colo.

Boulder Tungsten Increasing Production

The Boulder Tungsten Production Co., Boulder, Colo., is making plans to broaden its activities through the winter. A new ten-drill compressor plant has just been installed on one of the company holdings near Boulder Falls. The company's mill at Tungsten is now handling fifteen tons of ore daily on one shift. The labor force now employed totals sixty-five men. During the year, shipments of tungsten concentrates aggregated approximately $175,000 in value.

Extensive Improvements Planned by Phelps Dodge Corporation

The Phelps Dodge Corporation is planning an extensive development campaign in the Warren district, Bisbee, Ariz., in addition to improvements at the Douglas smelters.

A three-compartment shaft is to be sunk on claims purchased some years ago from the Warren Realty & Development Co. The shaft will be located just north of the Greenway school, in the townsite of Warren, and will develop entirely new territory. The ultimate depth planned for this shaft is 2,500 ft. This shaft will explore the country southeast of the new Campbell orebody of the Calumet & Arizona Mining Co., and if successful will add many hundreds of acres to the known orebodies of the Bisbee district.

It is also the intention to prosecute further development work from the present Calumet & Cochise shaft, on the 1,800 level. A drift from this shaft, on this lower level, has already reached a point near the crossing of Vista and Boulevard Sts., in Warren, and another drift, on the same level, runs directly south to a point on the Black Gap fault. The northeast drift will be extended to connect with the proposed new shaft. Work will begin on the new shaft before the first of the year, and completion of the program will probably take five years. Additional pumping equipment will be installed at the Calumet & Cochise shaft. This is the shaft from which the company has obtained its water supply for milling purposes since the concentrator began operations in April, 1923. It is estimated that this new development work will call for an expenditure of considerably more than a million dollars.

LEAD SMELTER FOR DOUGLAS, ARIZ.

Erection of a concentrating plant for lead-zinc ores near Warren, Ariz., and the erection of a lead smelting and refining plant at Douglas, work to begin immediately, has also been announced. The new lead concentrator will be an entirely separate plant from the big concentrator for copper ores now operating in the district, and will be some distance west of the present concentrator. It will be designed not only to handle Phelps Dodge ores, but custom ores as well, and though beginning on a modest scale will be so designed that it can readily be expanded as occasion demands. The flow sheet to some extent will follow the present flow sheet of the Shattuck-Denn concentrator, which has been operating successfully for more than a year.

Though the smelter and refinery at Douglas will handle custom ores, the Douglas plant will be built primarily for the treatment of lead ores and concentrates produced by the corporation's own properties at Bisbee and Tombstone. A. G. McGregor will prepare plans for the Douglas smelting and refining works. He also prepared the plans for the recent remodeling of the copper reduction works now being completed. The new lead-zinc smelter will occupy a part of the present plant at Douglas, which will be abandoned with the completion of the new reverberatory furnaces and roasting plant. It will be the first lead smelter to be erected in Arizona. Plans are now being drawn for the new concentrator by the engineering department of the company, and construction is expected to begin immediately.

California Mining Prospects Receive Permits

During the month of October, 1926, the State Corporation Department of California issued permits to the following mining companies:

Golden Eagle Development Co., to finance additional development on the Golden Eagle mine, in the Washington district, Calaveras County. The company announces its intention to sink its shaft deeper and to drift at greater depth in expectation of discovering orebodies. The company has also acquired an option on the Lone Point mine, in the same district. Rand Mountain Silver Mining Co., which has sunk a 430-ft. shaft on its property of eight claims, Randsburg, Kern County. Sierra Vista Mining Co., a privately controlled company which has expended $51,000 on a group of eleven mining claims at Bishop, Inyo County. Crucero Mining & Milling Co., which is opening up an old prospect in Tuolumne County. Milkmaid Exploration Co., operating the Milkmaid group of claims near French Gulch, Shasta County, under lease and bond. A 10-stamp mill has been put in operation and some production made from development.

Bright Star Gold Mining Co., which is exploring a group of eleven claims near Mokelumne Hill. Construction of a 10-stamp mill is contemplated. The Red Mountain Magnesite Co., Patterson, Stanislaus County, Calif., has acquired a magnesite property about 27 miles west of Patterson. Present equipment consists of a shaft kiln, and the company proposes to install a rotary kiln of 30 to 40 tons' daily capacity.

Taking of Testimony in Clark-Anaconda Apex Case Ended

The taking of testimony in the mining suit of the Clark interests against the Anaconda Copper Mining Co. is closed, with the case under advisement. Each side is to submit briefs, but it will be some time in January before Judge Bourquin is prepared to listen to arguments of counsel. At the conclusion of the case the judge announced that he was going to examine the ground and in doing so would take along a representative on each side, together with stenographers. Following the examination the judge leaves for California to hear cases in that state. The case, which represents a sum estimated at over $6,000,000, has attracted a large amount of interest, and though the court room was crowded every day, the general public did not obtain much information from the testimony of engineers and geologists as to who is right and who is wrong. Many distinguished men from various parts of the country were called to testify on both sides. It would seem that whatever may be the decision the case will go to a higher court for final determination.

German Aluminum Industry Increases Production

With aluminum production in Germany being increased progressively since the Inn Werke at Toeging, in Bavaria, went into operation last year, it is expected in that country that the 1926 production of raw aluminum will amount to from 20,000 to 25,000 tons, according to advices to the U. S. Department of Commerce. Though production of raw aluminum in Germany formerly was based on electrical energy derived from lignite, or brown coal, exclusively, about 40 per cent of current production is hydro-electric, the Inn Werke utilizing electric current generated by power from Bavarian waterfalls.

Initiation of production of hydro-electric aluminum in Germany is said to have enabled the Vereinigte Aluminiumwerke A. G., a leading German producer, to reduce the price of original smelter aluminum, 98 to 99 per cent, in rolled bars, to 2,140 marks per ton, against a former price of 2,400 marks, and ingots to 2,100 marks, against a former price of 2,360 marks. With increasing production, the German aluminum industry is reported to be enjoying friendly relations with foreign producers, particularly those of Switzerland Austria, and even France.

Third Discovery in Montbray Township

It is reported that another strike of much importance has been made on the Robb-Montbray claims, in northern Ontario, held by the Nipissing Mining Co. This group in Montbray Township is the original discovery that led to the staking boom of last autumn. The original staking was done by Quebec Prospectors, Ltd., and this property was optioned to Nipissing. Two other orebodies have been discovered during the present year prior to the latest find. The third orebody had the appearance of being higher in grade than any of the others, but sufficient work has not been done on it to demonstrate its economic importance conclusively. The latest discovery shows disseminated ore across a width of about 100 ft. and included in this body is about seven feet of massive chalcopyrite. This discovery was made close to the Nippissing camp.

Union Sulphur Investigating Deposits in Texas

Negotiations are under way whereby the surface deposits of raw sulphur which cover a large area in Culberson County 30 to 50 miles north of Toyah, Tex., may be taken over and developed by the Union Sulphur Co., of Sulphur, La. Thornwell Fay, Jr., representing that company, has been investigating matters connected with the proposed industry. Several attempts have been made at various times to commercialize these sulphur deposits, but their remoteness from transportation facilities prevented the success of the enterprises. An enormous tonnage of sulphur is in sight, and test holes show that the bed extends deep beneath the surface.

News From Washington

By PAUL WOOTON
Special Correspondent

Aluminum Cartel Being Formed in Europe—Lower Freight Rate on Idaho Lead Requested

EUROPEAN aluminum interests are considering a plan for united action in an effort to win back their pre-war markets, according to reports reaching Washington. Some sort of combination which will permit of mass production and other steps toward lower costs is held to be necessary if the European manufacturers hold their own against American competition. American plates and sheets and other forms of manufactured aluminum are being exported in large quantities to European countries as well as to other markets once supplied by European manufacturers. The combination can be made much stronger if it can include the Italian bauxite deposits. Negotiations to that end are said to be in progress. A survey is being made to determine just how these deposits can be used to the greatest advantage in the upbuilding of Italy. The plan is said to include the financing of a large plant and hydro-electric development in Italy.

IDAHO LEAD FREIGHT RATE EXCESSIVE

After extended consideration, W. A. Hill, an Interstate Commerce Commission examiner, has recommended that the commission find that the maintenance of rates on lead-smelter products, in carloads, from Bradley and Kellogg, Idaho, to Atlantic seaboard territory higher than contemporaneously applied on similar products from East Helena, Mont., and Utah smelting points to the same destinations was, is and for the future will be unduly preferential of East Helena and Utah lead smelting points and unduly prejudicial to Bradley and Kellogg. The case was brought by the Bunker Hill & Sulivan Mining & Concentrating Co. In his report Examiner Hill says, in part:

"The only other points in the West besides Bradley and Kellogg at which lead smelters are located are East Helena, Murray, Utah, and Selby, Calif. One formerly located at Northport, Wash., has been dismantled. The only lead refineries in the West are at Bradley and Selby. Complainant's shipments consist of refined lead in marketable form, whereas from the other lead smelters the product, in the form of lead bullion, must be shipped elsewhere for refining before it can be marketed. Refineries are located at points farther east, such, for example, as Omaha, Neb., and Grasselli, Ind., where the lead bullion may be refined in transit and the product forwarded to destination at the through rates applicable on the bullion from the smelting points. Still other refineries are located on the Atlantic seaboard. The smelters at East Helena and Murray, the smelter and refinery at Selby, and the refinery at Omaha are operated by the American Smelting & Refining Co., the largest handler of lead in this country.

"The distance from Bradley to Atlantic seaboard territory is 270 and 290 miles greater than those from East Helena and Murray, respectively; the distance from Northport is 489 and 509 miles greater than those from East Helena and Murray, respectively. Prior to the decision in the Anaconda case the rates from Montana and Utah smelters to destinations west of Atlantic seaboard territory had never been on an exact parity. As the rates from Bradley, however, applied over routes by way of which both Montana and Utah smelting points were intermediate, the requirements of the fourth section fixed the rates from the latter points on the same level. On Aug. 26, 1920, the rates were increased 33⅓ per cent, the rate to New York becoming $22. On Aug. 11, 1921, they were reduced to the basis which had become effective on June 25, 1918. Although not again reduced at the time of the general reductions of 1922, they were subsequently substantially reduced.

"All the copper refineries, except one at Black Eagle, Mont., and one at Tacoma, Wash., are located on the Atlantic seaboard, and all, or nearly all, of the copper bullion from the Utah smelters goes to these latter. Prior to 1921, defendants assert, the movement to these eastern refineries had been entirely over the all-rail routes. In 1921, however, the Western Pacific established a rate of $6.50, which became $5.85 on July 1, 1923, on copper from the Utah smelters to San Francisco for movement by water beyond. Up to that time the applicable rates for this movement dependent upon value had been $20 or more. As the water rates from San Francisco to the Atlantic seaboard ranged from $3 to $4, and as certain additional charges for such items as insurance and wharfage amounted to only about 90c. per ton, it will be seen that the maximum rail-and-water rate became considerably less than the all-rail rates. In August, 1923, defendants met the situation by reducing the rates on copper from Montana and Utah smelters to the Atlantic seaboard, the rate to New York becoming $12.50. No copper or zinc moves from Bradley, and for that reason similar reductions were not made from that point."

Defendants explain that regardless of whether the refined product was to be marketed on the Atlantic seaboard or at interior eastern points, the copper bullion produced by the Utah smelters first went to a seaboard refinery. Therefore, they state, it was much more susceptible to the competition of the rail-and-water routes than was the product of the lead smelters, which could move by rail through the refinery at Omaha or Grasselli direct to any interior eastern point. The same situation obtained with respect to the lead bullion produced at the East Helena smelter and to the refined lead produced at Bradley.

At present the rate from East Helena and Murray to New York is $12.50, with rates to the other seaboard points differentially fixed, and the rates from Bradley are $1 higher at the Atlantic ports and diminishing amounts higher at interior points in the destination territory. To these latter points, among which are Johnstown and Blairsville, Pa., where the differences are 60c. and 40c., respectively, complainant does not ship, its real interest apparently centering in the rates to Boston, New York, Philadelphia, and Baltimore, and points taking the same rates. Between March, 1924, and September, 1925, it shipped 30,857 tons of lead smelter products to these groups. Mr. Hill further states that:

"Competition in the marketing of smelter products is exceedingly keen, the difference of a fraction of a cent per pound frequently being sufficient to divert a sale. Complainant asserts that the American Smelting & Refining Co. practically determines the market price on lead, and that all others must meet that price."

Research Work at Houghton Making Progress

Progress is being made in iron and copper research work at the Michigan College of Mines, Houghton, Mich. On sulphur elimination from certain iron ores, over 100 experiments have been conducted to check up on analytical methods, and sizing tests have been made to determine the size in which sulphur is found. On particular ores, over 50 experiments in water leaching have been conducted. Concentration of low-grade ores has thus far been confined to the making of bibliographies and the study of technical literature on the subject.

In copper research work, the effect of certain impurities in the metal is being studied. Many experiments have been conducted, and recently there was developed a short, accurate method of determining the presence of arsenic. This is fundamental, as arsenic is one of the first impurities with which the metallurgist has to contend. The research staff has begun the collection of all data accumulated by metallurgists and chemists in the Michigan copper district, so as to correlate the information. This will eliminate much unnecessary duplication.

New Power Line for Ray, Ariz.

The new contract made by the Salt River Valley Water Users' Association with the Nevada Consolidated Copper Co. is expected to add a quarter of a million dollars to the annual revenue of the association. It calls for the delivery of 4,000 kilowatts of electric power to be generated at the Horse Mesa Dam and delivered to the company's mines at Ray, Ariz. The company will build 12 miles of transmission line at a cost of about $300,000 between the mines and the association's substation at Superior, Ariz.

Leonard Mine Temporarily Closed

The Leonard mine, one of the largest Anaconda producers in the Butte district, has been closed because of the breaking of the main shaft of the big hoisting engine. The mine will be closed between three and four weeks. A spare shaft is on hand and workmen were placed at work immediately in putting in the new shaft. Meantime the Anaconda mine has been put in operation, so that there will not be any loss in production. The Leonard employed 900 men and all have been transferred to the Anaconda except about one hundred, who have been retained at the Leonard.

American Mines and Smelting Acquires Caribou Property

The Caribou mine, near Boulder, Colo., an old-time silver producer, and other properties in the Caribou district have been consolidated into the American Mines & Smelting Co., Boulder.

The shaft of the Caribou has been sunk an additional 65 ft., making the lowest level 1,040 ft. deep, with a 25-ft. sump below that. Several veins have been opened, among them one which promises as rich returns as any of the oreshoots at higher levels.

Preparations are being made by the company to extend the No. 1 tunnel from Idaho hill to cut the Caribou at the 530 level. This would prospect 1,000 ft. of virgin territory between the two hills. It would also give a new water drainage-way 200 ft. lower than that now used. The tunnel is now in approximately 1,000 ft.

New Onyx Deposits Reported from Mayer District

Deposits of onyx, said to be of unusual beauty, are reported from the Yavapai Onyx Co.'s quarries, at Mayer, Ariz. The new pocket is about a quarter of a mile east of the present workings which, in itself, had been considered one of the finest deposits of the rock yet uncovered. The customary lines and strata of pigmentation which mark Yavapai onyx are supplemented in the new find with traceries and configurations in leaf and flower-like designs not heretofore found in one bed. W. O. Bedford is manager.

Airplane Geological Survey of Saskatchewan Planned

Plans are now far advanced for a comprehensive geological survey of the Province of Saskatchewan. Stores of gasoline and oil have been and are being placed at convenient spots, ready to supply two specially constructed sea planes which will start as early in the spring as possible in the making of aërial maps.

New Gold Dredge in Operation

A new gold dredge installed by Lawrence Gardella at Horsetown on Clear Creek, Shasta County, Calif., has been completed and placed in operation. About 200 acres of dredging ground is stated to be available.

Prospectors Active in British Columbia as Los Angeles Capital Enters Field

The British Columbia newspapers of Oct. 26 heralded in big headlines the bonding a "mountain of lead-zinc ore," near Nakusp, in the Arrow Lake district, by Los Angeles capitalists headed by J. Owen James, of London and Los Angeles. The consolidation includes the Big Ledge group, which was discovered 25 years ago. Desultory exploration has been undertaken from time to time, but the difficulty of getting the several owners of the claims to agree to sell at reasonable prices has militated against the introduction of capital to develop the property. According to A. G. Langley, provincial resident mining engineer for the district, the lode has been traced for several miles up the side of the mountain by a series of trenches and open-cuts. The deposit lies on the side of the mountain as a blanket, and, apparently, is of the bedded type, erosion having occurred in the plane of the hanging wall of the lode, exposing the sulphides at intervals for several miles easterly and westerly and from 50 to 300 ft. northerly and southerly. Judging from the number of openings that penetrate to the footwall, Mr. Langley estimates that the width of the lode ranges only from two to six feet. It would appear from old reports, he says, that the superficial extent northerly and southerly was mistaken for true width and gave rise to the impression that the deposit was one of vast size.

The ore consists of pyrrhotite, pyrite, and sphalerite, with which are associated in places small quantities of galena and chalcopyrite.

The new owners already have started work, and have men employed in the making of trails and the building of a camp. Two tunnels are to be driven during the winter, and diamond drilling will be started in the spring. The old workings are at elevations ranging from 5,500 to 7,000 ft., where a heavy mantle of snow prevents surface exploration during the winter.

Utah Mines Sustaining 1925 Production

A preliminary estimate of Utah metal production for 1926 based on the output of leading mines for the first ten months of the year indicates that the record of 1925, when $82,701,394 worth of non-ferrous metals was marketed, will be equaled or exceeded. Gold production should equal or exceed 177,000 oz., compared with 177,803 oz. for 1925; silver 21,000,000 oz., compared with 21,676,689 oz.; lead from 305,000,000 to 310,000,000 lb., compared with 306,669,824 lb.; copper, 245,000,000 lb., compared with 236,486,540 lb.; and zinc, 125,000,000 lb., compared with 52,611,732 lb.

The total value of the estimated 1926 metal production based on the average price of metals for the first ten months of the year equals $85,000,000. Dividends paid by Utah mines, not including the United States mine, which does not report its disbursements, will be approximately $14,000,000, compared with $12,690,000 for 1925.

The great expansion of the zinc industry is largely responsible for the increase in metal production during the current year. Mines which a year ago could not operate are shipping at capacity. The loss in revenues caused by the decline in the price of silver has been more than compensated for by the increase accruing from sales of zinc ores.

Most operators consider the growth of the zinc industry to be astounding. From 6,474,615 lb. of the metal produced in 1906 for a total of $394,952, production jumped to 52,611,732 lb. in 1925, valued at $3,998,491. This year's output should be nearly two and a half times in size and value that of last year. Credit for this phenomenal expansion must go to the Combined Metals Reduction Co. and the International Smelting Co., which first started the treatment of zinc ores by selective flotation. Completion during the year of the new 750-ton plant of the United States Smelting, Refining & Mining Co. at Midvale, and the enlargement and installation of flotation units by the Silver King Coalition Mines, the Park-Utah, the Chief Consolidated, and the Utah Apex, have also given zinc production a tremendous impetus.

A study of production by districts furnishes some surprising facts. Last year, the Park Utah Consolidated Mines Co., with a total production of 4,815,000 oz. of silver, became the state's leading silver producing company. This year, the company's output of the white metal bids fair, if maintained at the same rate during the last two months of the year as for the first ten, to exceed the 1925 record by approximately 1,000,000 oz., setting a mark of 5,800,000 oz., the highest ever attained by any Utah company.

Silver output of the Park City district will hold about the same as last year by reason of this increase, notwithstanding the slight decrease in the silver output of the Silver King Coalition Mines and the shutdown of the Keystone mine.

Engels Copper Mills 36,121 Tons per Month

During September, the Engels Copper Mining Co. at Engelmine, Plumas County, Calif., milled 36,121 tons, producing 2,383 tons of concentrates, containing gold 149 oz.; silver 14,846 oz., and copper 1,148,383 lb. For the nine months of 1926, ore milled totaled 327,150 tons; concentrates 20,577 tons; gold 1,247 oz., silver 138,192 oz., and copper 10,392,499 lb. Net operating income for the period totaled $197,522; other income was $14,333.

Coleraine Ore Washer Closes for the Season

The Oliver Iron Mining Co. suspended operation of the Trout Lake iron ore concentration plant Nov. 3 It will be closed until the opening of the shipping season next spring. Ore shipments will continue from the higher-grade ore pits until the close of navigation.

Mexico City Letter

By W. L. Vail

Special Correspondent

Mexico, Producer of 40 per Cent of World's Silver, Seriously Hurt by Low Price

Mexico is feeling seriously the effects of the depression in silver. Next to oil, silver is her great national asset. The heavy drop in price, together with what mining men declare to be a ruinous freight rate for ores; the unfavorable features of the new mining laws, and excessive taxation on metal production and exports, with restrictive regulations, threaten to paralyze many of the camps now operating and to bring about serious labor problems.

Mexico produced in 1925 a total of 92,915,168 oz. of the white metal, of a world production of 241,575,094 oz., or nearly 40 per cent. According to figures given out by the Department of Commerce, Industry and Labor, Mexico's production for the first six months of 1926 shows an increase of 9½ per cent over a corresponding period of the preceding year; therefore, if the ratio is maintained for the last six months of the year, production for 1926 would be 101,742,108 oz. Mexico has been for some years the largest silver producer in the world and must feel most keenly, therefore, the depression in price.

While a large number of the silver properties of Mexico carry copper, zinc, lead, and other values, many have no secondary values and will be forced to suspend operations if the present price of silver and other unfavorable conditions are sustained.

Some interesting statistics have been prepared by Jenaro Garcia, President of the Mexican National Chamber of Mines, bearing on the silver production of the principal mines now operating in the republic. Mines producing under 20,000 oz. per month are not included:

Monthly Production and Cost per Ounce

Companies	Monthly Production, Ounces	Cost per Ounce U. S. Cy.
Pachuca		
Real del Monte and Pachuca	1,524,585	$0.56
Santa Gertrudis	610,236	.56
San Rafael y Anexas	259,689	.57
Purisima Grande	20,521	.78
El Oro and Tlalpujahua		
Mexico Mines of El Oro	53,497	.57
Dos Estrellas	106,587	.56
Jalisco		
Cinco Minas	200,000	.62
Amparo	22,183	.77
San Pedro Analco	74,681	.68
Zacatecas		
Mexican Corporation	350,000	.57
Guanajato		
All the mines	226,799	.64
San Luis Potosi		
Santa Maria de la Paz	327,878	53
Sonora		
El Tigre (with 30-oz. ore)	208,333	.36
Chihuahua		
Cusi Mining Co.	64,300	.55
Average cost of production		.56105

About 250,000 oz. monthly may be added to these figures for smaller properties scattered throughout the country, with a production each of less than 20,000 oz. monthly, and the balance of the net production of 8,000,000 oz. for the entire republic comes from mines principally in Lower California, Durango, Sonora, Coahuila, and Chihuahua. It is stated that 55 per cent of the silver production of Mexico comes from "straight" silver mines.

Operations Curtailed

Even with a reasonable reduction in taxes and a readjustment in wages, most of the more important properties will be forced into selective mining, a considerable reduction in operating expenses, and a practical abandonment, for the present, at least, of all exploration activities. Others, on account of the low grade of the ores, may be obliged to suspend completely, regardless of artificial assistance; notably, in Guanajato, Zacatecas, El Oro, and certain properties in Pachuca. In the first readjustment Pachuca mines laid off 1,470 men, but, thanks to the sagacity of the management, labor friction was avoided. Angustias, Michoacan, has made a reduction of 25 per cent in the payroll. Amparo and Mazata, Jalisco, may be forced to suspend; and Piedra Bola hopes to continue on account of the ore values. Dos Estrellas also may be forced to shut down.

Tax Reduction Asked

For the purpose of alleviating the situation, meetings are now being held daily between representatives of the Treasury Department, the Department of Commerce, Industry and Labor, the Federal Congress and the National Mining Chamber. A bill is before Congress proposing to exempt silver below 60c. per ounce from taxation. The Treasury Department, with an idea of defending its supposed interests, suggests a tax of 1 per cent per ounce with silver at 52c. and a gradual increase as the price rises to 58c. per ounce, with a resumption of payment of the full present tax of 5½ per cent above 60c. per ounce.

The National Mining Chamber presents a plan for exemption from taxation below 50c. per ounce; 1½ per cent from 50 to 55c.; 3 per cent from 55 to 60c. and 5½ beyond 60c. Concession along the above lines would mean a loss to the treasury of about 12,000,000 pesos per annum, according to treasury officials. Quite naturally that department is attempting to work out some solution less drastic to itself. For instance: There appears to be a disposition on part of the government representatives to hang some of the losses onto the larger mining companies, on the grounds that large profits have been made in the past and a sort of 50-50 arrangement might be entered into with the government for participation in the losses. One government official advances the theory that while the fall of silver will naturally affect many mining interests working on low-grade ores, it will stimulate the companies holding high-grade reserves to intense production, thus really providing larger profits for the stockholders at the end of the year. The government also contends that at least 40 per cent of the silver properties in the country carry high values in zinc, lead, or copper, which with present favorable prices guarantee excellent profits. In other words, the government's point of view, at least for the purpose of official conversation, is much less pessimistic than that of the mine owner.

London Letter

By W. A. Doman

Special Correspondent

Optimism Prevails in Tin Industry Despite Lower Price—Southern Rhodesia Promising

London, Oct. 26—Two or three weeks ago I mentioned the case of the Southern Rhodesia Base Metals. Other rumors now reach me. P. K. Horner is on his way home from Rhodesia, and is said to have brought a very favorable report upon the company's properties. When the shares were rising, statements concerning the richness of one of the deposits were scarcely believed, and A. Chester Beatty counseled patience until further proof was forthcoming, as he was averse from being associated with a failure, his view being that if the reports were incorrect much harm might be done to Rhodesia and render it difficult to raise capital in the future. The story now goes that he sold his shares in the belief that they might prove to have advanced too fast, and having no representation resigned with a colleague from the board. He is reported to be buying the shares again on what is believed to be a forecast of P. K. Horner's report. How the statements originate is a mystery, seeing that Mr. Horner is on the water. However, I understand that his report will say that the deposit has been traced for a distance of anything from eight to ten miles, and that it has an average of something like 60 ft. in width.

The pool formed to operate in Lena Goldfields has, I understand, taken in the shares at 6s. 9d. and will terminate at the end of January next year.

In discussing the tin position with various mining engineers and other persons interested, I find that despite a drop in the price of the metal, optimism as to the future is in evidence. The reasons given are those I have mentioned previously: no further discoveries, and the slow rate at which production by existing companies can be increased. One remark, however, appeared to me to be rather ominous: A certain big company is forcing its output for share market purposes. I refrain from mentioning the company, as an assurance would be conveyed to me that such is not the case. Another matter that indicates a little weakness in the position is that in some recent flotations of tin areas the promoters have looked after themselves rather liberally. Another Cornish tin company has been registered. It is Parkanchy Tin, and has a capital of £175,000 in 5s. shares. The board consists of Lord Askwith, Sir W. D. Henry, W. H. Edwards, Reginald Pawle, and E. T. McCarthy.

Hitherto the Johannesburg Consolidated Investment Corporation, of which Solly Joel is chairman, has not taken a lively interest in platinum propositions in South Africa, but there is now a possibility of a change of attitude. Solly Joel is on his way to the Cape, and the annual meeting of shareholders is postponed for his presence. He says that in the event of certain properties being favorably reported upon, he may undertake to develop and work them.

Situation at the Mines

By Albert H. Fay
Assistant Editor

DURING the last month three important metal combines have been projected. First, the Copper Exporters, Inc., formed under the Webb-Pomerene Law for the purpose of exporting copper and copper products. It will also have a stabilizing effect on export prices, inasmuch as about 95 per cent of the world's copper production is represented. Second, through the leaders of the German aluminum industry, a tentative agreement has been reached whereby French producers will probably be included in the European Aluminum Cartel. The stated object is not so much the curtailment of production to raise prices, as to increase production by invading the world's markets. The third is the formation of the European Iron and Steel Entente, which should stabilize Continental iron markets and production.

Average Prices May, 1926, to October, 1926

	In Cents			
	Copper	Lead	Zinc	Silver
Average, 1925	14.042	9.020	7.622	69.065
May, 1926	13.599	7.751	6.821	65.075
June	14.656	8.033	7.112	65.481
July	13.924	8.499	7.411	64.793
August	14.174	8.908	7.376	62.380
September	14.062	8.786	7.413	60.580
October	13.862	8.402	7.296	54.505

Copper—Litigation in the copper industry is not at an end. At Butte, Mont., two important cases are pending, the Carson patent case and the Clark-Anaconda apex case, each involving millions of dollars and calling for expert witnesses on each side. In the case of the Idaho Copper Corporation vs. Inspector Campbell, in Idaho, the court upheld Campbell in his effort to prevent fraudulent promotion schemes. Western copper production is maintained at its high rate, but there is sufficient excess capacity to increase output if necessary. Leaching of copper ore has started at the Inspiration 7,500-ton plant. In Quebec developments are proceeding rapidly at Rouyn, the railroad having been completed to the new camp late in October. Considerable prospecting is being carried on in the vicinity of Rouyn, as well as in Manitoba, where the Flin Flon Copper Co. has a pilot plant about ready for operation.

Mining activity continues throughout British Columbia. For this year up to the middle of October 452,693 tons of ores and concentrates were received at the Trail smelter, of which 324,642 tons came from the Consolidated company's mines and the remainder was provided by 96 independent operators. It should be remembered that most of the ores from the mines on the coast are shipped either to Anyox or Tacoma; small quantities are sent to the Selby smelter and a little is shipped to European plants. The October production of refined copper in Michigan is estimated at 14,475,000 lb. Metal business continues good in the Michigan district, with New England taking the bulk of shipments. This copper is moving by boat.

Gold—In the Porcupine and Kirkland districts of Ontario the grade of ore handled is decreasing, but with this comes the handling of larger tonnages and more efficient milling processes, so that costs are now comparatively low, averaging about $4 per ton, and it is now possible to handle these ores at a profit. A new gold reef is reported about 25 miles northeast of Rustenburg, South Africa, and by the consolidation of old and practically exhausted mines with undeveloped adjoining properties, the South African companies are utilizing the old mine workings through which to gain access to extensions of known orebodies in place of sinking additional shafts, thus obviating an enormous capital outlay for new shafts and equipment. The Rand recently celebrated its fortieth anniversary and is producing more gold today than at any time in its history. Dredging operations continue in Alaska and California, but not on as large a scale as in former years. The possibility of the renewal of hydraulic operations in California becomes brighter with the appointment of engineers to make a study of impounding the débris. No new important gold discoveries have been made recently, and developments at Red Lake, Canada, have not gone far enough to be used as a basis for anticipating future production. Canada is accumulating a surplus of gold at Ottawa, the receipt being about $2,000,000 monthly.

Silver—With the price of silver the lowest in years, those operators whose chief product is silver are experiencing the hardest time they have had for many months. This is especially true in such camps as Guanajuato, Mexico, where they are cutting expenses to a minimum and even reducing the number of employees on the payroll. Various state and local chambers of mines and mining organizations are petitioning both the state and federal government of Mexico to suspend temporarily those laws relating to tax until silver is again above 60c. per ounce. The producers in the Western States are feeling the pinch of the low price and the Silver Producers' Association has drawn resolutions calling for a change in the Indian monetary system to prevent dumping on to the world market of a large silver reserve held in that country. Since 50 per cent of the silver in the United States is a byproduct of copper, lead, and zinc mining, the real loss to this country is not so great as in the case of the Mexican and Canadian mines. The loss on byproduct silver is in a measure offset by recoveries of zinc, which in former years was thrown into the discard or penalized on smelter shipments. In the meantime prospecting for lead, copper, and zinc continues, and as new properties are brought to the producing stage, increased production of silver will continue regardless of the price. What the silver producers need now are new and wider uses for the white metal, and it is reported that $300,000 has been provided for research into the possibilities of new industrial applications for the metal.

Zinc-Lead—In the Joplin-Miami district prospecting and development continue, with about 400 drills actually at work. The large companies are safeguarding against exhaustion of orebodies by securing control of prospective mineral lands to be held in reserve for future use. At the close of October 163 mills were in operation, producing about 17,000 tons of zinc concentrate per week. An important development in this area is the reworking of old tailing piles, of which there are millions of tons. Many of these resulted from the early days when the milling efficiency was far below that of the recent flotation process. Many of the old mining sections that were worked out several years ago are being drilled and prospected for ores in deeper levels.

In the Coeur d'Alene district, in Idaho, and in British Columbia increased facilities are being added to take care of the zinc byproduct from the increasing volume of lead and copper ores. Custom mills are now taking care of an appreciable tonnage of ore from the small mines, in many cases the zinc byproduct being the safety factor between success or failure of small properties. A contributing factor to the revival of mining in Colorado is the ability to save the zinc, which at one time was considered a liability. In fact, old dumps are being reworked for recovery of zinc and other metals.

Iron—Lake shipments for October amounted to 9,337,463 tons, which is 200,000 tons in excess of the highest October tonnage. The total season's ore shipped up to Nov. 1 this year was 54,568,371, or 4,751,902 tons more than in the same period of last year. Shippers are making every effort to fill all orders now on hand before close of navigation. The season's shipments will probably exceed 60,000,000 tons.

Labor—Press dispatches indicate that in Colorado the mine operators are calling for more miners. The shortage of labor, both skilled and unskilled, is especially noticeable in Cripple Creek, Leadville, Bonanza, and Rico. There is also a shortage of labor in New Mexico, where there is some activity in developing old properties. In the iron country, Minnesota and Michigan, there is ample labor. At the copper mines there has been a slight shortage, but as winter approaches the return of miners from the agricultural districts is filling the vacant places. In other mining districts there has been no shortage actually reported, nor has there been any indication of a surplusage of labor at any of the camps, except at silver camps in Mexico, due to the low price of silver.

People You Should Know About

Courtenay De Kalb has returned to New York from Paris.

Alan Bateman has returned to New Haven from professional work at Butte, Mont.

Ira B. Joralemon, mining engineer, has returned to San Francisco after a business trip to Mexico.

Bulkeley Wells has associated himself with the Julian Merger Mines, Inc., as director of mining operations.

Louis Douglas, son of J. S. Douglas, and president of the Grand Central Mining Co., has been elected Democratic Congressman from Arizona.

Edward Thornton, vice-president of the Southwestern Engineering Corporation, of Los Angeles, was in New York City the early part of this month.

C. Page Wood, formerly assistant secretary of the Ferreira Deep, is now secretary of Onverwacht platinum mine, in the Lydenburg district, Transvaal.

H. C. Boydell, who for the last five months has been at Tyrone, N. M., for the Phelps Dodge Corporation, has returned to the Massachusetts Institute of Technology.

E. C. O'Keefe, of Wallace, Idaho, metallurgist in charge of the ore testing plant of the American Smelting & Refining Co., has returned after a month's absence in Colorado.

Charles E. Kehoe, for the last five years mine superintendent of the California Rand Silver, Inc., Randsburg, Calif., has returned to Los Angeles since the closing down of that mine.

W. J. Hamilton, an engineer formerly associated with the Cerro de Pasco company, has been appointed a director of the Don Rouyn Mines, Ltd., operating in the Rouyn area of Quebec.

D. G. H. Wright, of the Dome Mines, Ltd., is making an examination of the Duncan-McBain properties in Narrow Lake, Ontario, which are owned by **R. Home Smith** and **J. H. Black**, of Toronto.

G. H. Bourhenne, recently with the Minas del Tajo, Rosario, Sinaloa, has accepted a position as mine foreman with the American Smelting & Refining Co. and left Rosario on Nov. 1 to assume his new duties.

A. B. Emery, general manager of the Messina (Transvaal) Development Co., Ltd., and Mrs. Emery left Johannesburg on Sept. 25 on a visit to Europe and America.

L. R. Robins has resigned as general superintendent of Tonopah Belmont Development Co. operations in Arizona. He is succeeded by **Fred H. Penn**, who has been with the Belmont company at Tonopah, Nev., and Surf Inlet, British Columbia, for many years.

H. A. Rands, after a year in Nome, Alaska, with the U. S. Smelting, Refining & Mining Co., has returned to the United States and is now with the Washington Water Power Co., Spokane, Wash. He is engaged on the Lake Chelan hydro-electric development.

D. E. A. Charlton, recently district manager for the Highway Lighthouse Co., and formerly business manager of *Engineering and Mining Journal*, has been appointed advertising manager of *Packing and Shipping* and elected a director of Packing and Transportation Publications, Inc.

E. J. Gealy, who during the past four years has been on the staff of *Coal Age* as electrical and mechanical editor, with headquarters in New York, has now been assigned similar duties on the staff of *Engineering and Mining Journal*. Mr. Gealy is a graduate of the Pennsylvania State College and for several years was an electrical engineer with the Lehigh Valley Coal Co., one of the largest and most fully electrified anthracite companies. In the course of his career Mr. Gealy has also served as director of engineering extension service conducted by the Pennsylvania State College; as engineering consultant on matters pertaining to mining and as marketing counselor for several of the McGraw-Hill engineering papers. Mr. Gealy has made several noteworthy contributions to the modernization of mining, both in practice and as author of several articles pertaining to haulage, automatic pumping, hoisting, and electrical and mechanical features connected with many of the latest practices in mining and technical operations.

E. J. Gealy

Dr. T. C. Phemister has been appointed assistant professor of mineralogy and petrography at the University of British Columbia. Dr. Phemister has made a study of the **Sudbury nickel** deposits and has written a memoir on the subject which has been published by the Ontario Department of Mines.

Waldemar Lindgren, head of the department of geology, Massachusetts Institute of Technology, was in Wallace, Idaho, recently. He visited the Morning mine, owned by the Federal Mining & Smelting Co., presumably in connection with the pending litigation involving payment of dividends on Federal common stock.

Sir Douglas Mawson, professor of geology and mineralogy in the University of Adelaide, with Lady Mawson reached Johannesburg on Sept. 26, via Durban. Sir Douglas is a native of Yorkshire, but was educated in Sydney University, where he graduated as a bachelor of mining engineering in 1901. He was leader of the Australia Antarctic expedition in 1911-1914.

R. W. Handley, formerly concentration superintendent at the International Smelting Co.'s lead-zinc concentrator at Tooele, Utah, left recently to go to Africa to accept a position with the Union Minière du Haut-Katanga. His place at Tooele is being taken by **W. J. McKenna**, formerly concentrator metallurgist. **M. C. Haas**, from the concentration department laboratory at the Tooele plant, will succeed Mr. McKenna.

William H. Auret Pritchard, South African Government land surveyor and one of the pioneers of the Witwatersrand, clad in the garb of an early gold digger, gave a most interesting lecture on "The Early Days of Johannesburg and the Rand," at the Scientific and Technical Club, in connection with the fortieth birthday celebration in Johannesburg in September. One of the principal streets of "the golden city" is named after him.

R. W. Brock, dean of the faculty of science, and **C. McLean Fraser**, professor of zoology, represented the University of British Columbia at the Pan-Pacific Science Congress, at Tokyo, during the latter part of October and the early part of November. Dr. Brock also will represent the Canadian Government, the Royal Society of Canada, and the Hong Kong Government at the congress. Following the congress, Dr. Brock will go to Hong Kong, to complete the geological survey of the colony, which he started some years ago and which since has been carried on by other members of the faculty of science of the University of British Columbia.

Obituary

Alfred Merritt, long identified with the Mesabi range, and who is credited with having driven the stake for the test pit of what subsequently became the Mountain iron mine, in the Mesabi, died last week in Duluth at the age of seventy-nine. With his brothers, Mr. Merritt took a conspicuous part in the promotion of the Duluth, Missabe & Northern Railway and the building of ore docks at Duluth. He is survived by his widow, seven children, and thirteen grandchildren and by his brothers, L. J. Merritt and A. R. Merritt.

J. Hurst Hawthornthwaite, who for many years had been an active figure in mining and political life in British Columbia, died at his home, Burleith House, Victoria West, on Nov. 1, aged fifty-seven. Mr. Hawthornthwaite represented first Nanaimo and later Newcastle in the interest of socialism in the Provincial Legislature. His mining activities ranged from coal to gold. At the time of his death he was president of the Stewart Consolidated Gold Mining Co., which has been doing a considerable amount of exploration in the Cassiar district of British Columbia.

Recent Technical Publications

Reviews, Abstracts, and References

The Development of Orebodies

The Location of Mineral Fields. By M. H. Haddock. Published by Crosby Lockwood & Son. London, England. Price 9s. 6d.

Unlike a great number of mining books published in the British Isles which are given inclusive titles and, on examination, are found to be written only for coal miners, this volume treats of the metal-mining field as well. Without any preliminaries, the author begins with a discussion of the geometry of dips and strikes and then proceeds to the subject of outcrop and mineral mapping and contouring. A chapter on borehole surveying relates the difficulties met with in trying to ascertain the deviation of a borehole from a straight line and how they are overcome. Under the heading "Applied Geophysics" another chapter is given to electrical and gravitational methods of prospecting, methods that have received a great amount of attention in recent years. The application of spherical geometry to methods of surveying, triangulation, and the correlation of surface and underground surveys occupies the concluding portion of the work. The mathematical basis and theory behind many of the methods used in surveying, mapping, and prospecting is emphasized throughout the text but not to the subordination of practical details. Although much of the material covered may be found in other texts on engineering topics, the book is unique and useful in providing these data in one handy volume. F. E. WORMSER.

Chemical Engineering Catalog. Eleventh annual edition. Chemical Catalog Co., 19 East 24th St., New York City. Leasing fee, $2 a copy in the United States; $3.50 in Canada and European countries. Outright purchase, $10.

This volume of close to 1,200 pages is a familiar work of reference to those who buy and specify equipment and materials in the industries using chemical processes. The first section is a classified index of equipment and materials, giving the names of manufacturers and dealers covering all kinds of commodities from "abrasives" and "absorbers" to "zirconium sulphate," "zirkite brick," and "zirkonalba refractories." Most of the individuals and companies mentioned have condensed catalogs of their products in the next section of the book, the "equipment and supplies section." The final section of the book is devoted to a catalog of over 2,000 technical books, indexed both by subject and by author, and giving the date of publication, size, and price, but not the name of the publisher. The volume is a handy source of reference for many questions regarding marketing information.

Slate Technology—Oliver Bowles has recently written a 9-page bulletin on "Recent Progress in Slate Technology," published by the U. S. Bureau of Mines, Washington, D. C., as *Reports of Investigations* No. 2,766, and obtainable on request. Dr. Bowles discusses mills for the manufacture of roofing slate; the use of the gang saw; the air-driven slate splitter; "Struco," a new slate product; improvements in quarry drainage; architectural slates; and various minor topics.

Fluorspar—*Skillings' Mining Review*, Duluth, Minn., recently published in two parts a story on the Illinois-Kentucky Fluorspar District, describing the mines and milling practice. Price of the issues containing each part, 10c.

Silver Commission Report—Those who wish to have a full knowledge of the Indian silver commission's work may get a rather detailed account of the proceedings by consulting Vol. 1 of the "Report of the Royal Commission on Indian Currency and Finance," pp. 144, obtainable for 2s. 6d. from H. M. Stationery Office, Adastral House, Kingsway, London, W. C. 2, England.

Approved Appliances—A list of inspected gas, oil, and miscellaneous appliances, approved by the Underwriters' Laboratories, 207 E. Ohio St., Chicago, is available on request. This 72-page bulletin is an excellent directory of manufacturers of such material as acetylene equipment, gasoline appliances, hose, oil burners and accessories, meters, tanks and accessories, and gages.

New Patents

Copper Leaching — No. 1,602,795. Oct. 12, 1926. W. E. Greenawalt, Denver, Colo. Copper sulphide ores are concentrated into a small amount of high-grade concentrate and a relatively large amount of low-grade concentrate. The latter is roasted, and leached with acid. The high-grade concentrate is heated to dissociate the copper and sulphur, and the sulphur vapor then treated with a hydrogen-containing gas to form hydrogen sulphide, which is, in turn, used to precipitate the copper from the solution obtained in leaching the low-grade ore.

Crushing Machinery

No. 1,602,733. Oct. 12, 1926. W. S. Weston, Columbia, S. C. Design for a dust collar for gyratory crushers. Patent No. 1,602,734, issued to the same applicant, also covers a special design for a gyratory crusher.

No. 1,603,765. Oct. 19, 1926. J. S. Haas and Richard Bernhard, Allentown, Pa., assignors to Traylor Engineering & Mfg. Co., Allentown, Pa. A safety device for jaw crushers.

No. 1,605,007. Nov. 2, 1926. C. F. Smith and H. H. Rumpel, Milwaukee, Wis., assignors to Smith Engineering Works, Milwaukee. A crushing mill with a horizontal shaft on which is mounted a conical crushing head acting against a concave member separately mounted.

No. 1,605,012. Nov. 2, 1926. E. B. Symons, Hollywood, Calif., assignor to Symons Bros. Co., Milwaukee, Wis. A feed spout for disk crushers of the Symons type.

No. 1,605,050. Nov. 2, 1926. W. T. McNinch, Chicago Heights, Ill., assignor to American Manganese Steel Co., Chicago. Design of a roll for gyratory crushing mills.

Centrifugal Separator—No. 1,603,125. Oct. 12, 1926. F. D. Lewis, Denver, Colo. A rotary centrifugal mineral separator composed of several coaxial cylinders attached to a horizontal shaft, the inlet being to the innermost cylinder.

Dry Concentrator — No. 1,603,213. Oct. 12, 1926. J. F. Reilly, Patagonia, Ariz. Design for a dry concentrating table, compressed air being forced through the porous covering of the table.

Zinc Ore Roaster—No. 1,603,442. Oct. 19, 1926. Georg Balz, Eichenau, Poland. A multiple-hearth roasting furnace adapted to the treatment of blende, a rotating movement being given to alternate hearths.

Sluice Boxes—No. 1,603,695. Oct. 19, 1926. A. D. Hinton, Berkeley, Calif. A frame and cage containing several inclined sluice boxes suspended on hangers so that a rocking motion to the whole can be given.

Rock Drills

No. 1,604,957. Nov. 2, 1926. L. C. Bayles, Easton, Pa., assignor to Ingersoll-Rand Co., Jersey City, N. J. Oiling device for a rock drill mechanism.

No. 1,605,148. Nov. 2, 1926. W. A. Smith, Atkins, Pa., assignor to Ingersoll-Rand Co., Jersey City, N. J. A chuck for rock drills.

Nos. 1,605,712-15. Nov. 2, 1926. G. H. Gilman, Boston, Mass. Designs for a rock drill.

Electric Separator—No. 1,605,117. Nov. 2, 1926. Mitsuo Koizumi, Anshan, China, assignor to Minami Manshu Tetsudo Kabushiki Kaisha, Dairen, Kwang-Tung, Manchuria, China. An electric ore separator employing a rotary magnetic field to impart rotary motion to mineral particles and cause them to travel upward on baffles and fall into channels that are provided.

Gravity Separation—No. 1,605,172. Nov. 2, 1926. T. M. Chance, Philadelphia. A method of washing coal and concentrating ore, by flotation of the lighter and sinking of the heavier materials in a fluid, the specific gravity of which is greater than the lighter particles and less than that of the heavier particles. The fluid in which the separation is performed is an agitated mass of liquid and ground solids that are insoluble in the liquid.

Zinc Recovery—No. 1,605,640. Nov. 2, 1926. J. O. Betterton, Omaha, Neb., assignor to American Smelting & Refining Co., New York City. Zinc dross is heated to volatilize the flux residue and to oxidize the metallic zinc carried therein.

No. 1,605,641. Nov. 2, 1926. Same applicant and assigned as above. A process for the recovery of zinc compounds from the blue powder residue of lead refining, which includes the step of adding the residue to fused zinc chloride, maintaining the mass at a temperature to dissolve the zinc oxide from the residue. and causing the particles of metallic zinc to coalesce and separate from the mass.

Societies, Addresses, and Reports

Mine Safety Discussed in Detroit

Section of National Safety Council Hears Papers—H. I. Young New Chairman

By R. Dawson Hall
Engineering Editor, *Coal Age*

ABOUT 5,000 delegates of member companies attended the annual meeting of the National Safety Council at Detroit, Mich., Oct. 25-29. The mining session brought together delegates from all sections of the industry and from every part of the United States.

Charles S. Hurter, technical representative, E. I. du Pont de Nemours & Co., delivered an address on "Safe Practices in Blasting" based on his experiences in the Lake Superior iron district. This concerned the handling of dynamite above and below ground and the use of that dynamite in deep holes with both springing and blasting shots. He also gave some counsel about mud capping. His advice that cases of dynamite be opened with hard wood mallets and wedges is timely. A few mines he said use copper wedges, and in the past phosphor-bronze chisels were used extensively, but because of the brittleness of this alloy and the greater safety of wood they have been almost completely discarded. Excellent wedges can be made from broken pick and shovel handles. Wedges for opening dynamite cases should be kept clean and free from grit. In fact, friction from grit must be avoided as much as possible, said Mr. Hurter, in the handling and use of explosives.

Mr. Hurter urged that care be taken to short-circuit the leads until the moment of firing. He added that one might ascertain that there was little or no stray current, and proceed on that ascertainment, only to find that the current was there, but not passing when the test was being made. It comes and goes irregularly. He also said that one iron company made it a rule to shut off the power for locomotives before firing shots so as to prevent the possibility of stray currents igniting the charges.

A. J. M. Ross, general mine foreman, Homestake Mining Co., Lead, S. D., then delivered an address on "Methods of Promoting Safety Interest at the Homestake Mine." He spoke of the opposition to the introduction of the safety engineer as the intrusion of a stranger who presumed to tell more experienced bosses what they ought to do. Mr. Ross then described the central safety committee of his company, which consists of officials, and also the workmen's committee, consisting of nine men from the mine and five others from the other departments, all elected by secret ballot. No boss may be elected, nor may any man vote for any one outside of his own level or division. He said that he had men who were injured as often as three times a year. After making sure that the men were trying to do their work in a safe manner, they were sent to the medical department for an eye examination.

H. C. Henrie, manager, labor department, Copper Queen Branch, Phelps Dodge Corporation, Bisbee, Ariz., discussed employees' representation at the mines with which he is associated and the relation of industrial representation to the safety movement. Mr. Henrie stated that his company had been operating in the Bisbee district since 1881 and that during those forty-five years labor disputes had been rare. At present 92.1 per cent of the underground employees are American citizens. Mexicans are employed for unskilled surface labor and constitute 18.5 per cent of the total force. Exclusive of Mexican labor 95.1 per cent of the total number of employees are citizens. Sixty per cent are married and have their families residing in the district.

"The representative plan," said Mr. Henrie, "is modeled after our federal Constitution and provides for three departments—legislative, executive, and judicial. The legislative consists of a House of Representatives and a Senate. The House is composed of representatives, one-half of whom are chosen every six months, at elections conducted by the employees, to serve a term of one year. Electoral divisions are based on the natural divisions of operations and arranged so that every department is represented.

"The manager," said Mr. Henrie, "is permitted to attend the meetings of either house at any time and participate in a discussion of any measure, but has no vote." All grievances not settled satisfactorily to a complaint by the grievance committee, which consists of three workmen appointed by the Speaker of the House of Representatives and two members of the supervisory staff appointed by the President of the Senate, can be carried to the Supreme Court, consisting of a representative of the employees, one of the company and a third who is required to be a well-known citizen of the community having no connection with the Phelps Dodge Corporation.

"In August, 1922, the manager met," said Mr. Henrie, "with the House of Representatives and stated that the wage schedule of the company needed a revision which might increase certain occupational rates and possibly reduce others. After reference to the wage-and-bonus committee, which met representatives of the management, the new scale was passed by both houses, approved by the manager, and accepted by the employees."

On Wednesday morning the nominating committee for the Mining Section brought in its report, recommending H. I. Young, general manager, American Zinc Co., Mascot, Tenn., as chairman and C. A. McDowell, industrial relations department, Davis Coal & Coke Co., Thomas, W. Va.; George Martinson, safety engineer, Pickands, Mather & Co., Hibbing, Minn.; A. W. Dickinson, general superintendent, Union Pacific Coal Co., Rock Springs, Wyo.; and J. L. Hodgson, manager, Phelps Dodge Corporation, Morenci, Ariz., as vice-chairmen with Daniel Harrington, chief engineer, safety service, U. S. Bureau of Mines, Washington, D. C., as secretary. This ticket received the unanimous approval of all present. B. C. Yates, superintendent, Homestake Mining Co., Lead, S. D., chairman of the section, who presided at this as at other sectional meetings, advocated the appointment of a paid secretary for the section. In this, Mr. Hodgson concurred.

New York Section Hears Dr. Guertler on Alloys

More than 30,000,000 tons of metals are lost annually by rust, according to a statement made by Dr. William M. Guertler, at a talk on the corrosion resistance of metals, given recently before a joint meeting of the American Society for Steel Treating, Institute of Mining and Metallurgical Engineers and the American Institute of Metals at the Engineering Societies Building in New York.

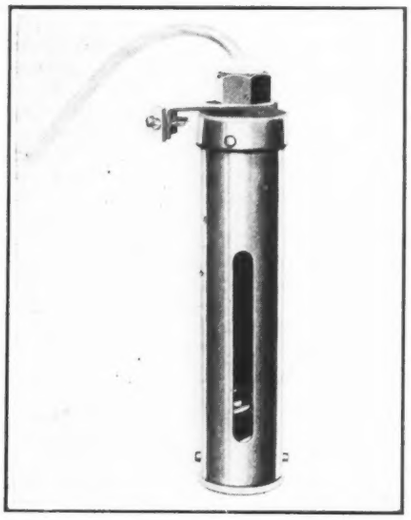
Dr. Guertler is one of Germany's foremost metallurgists, and is at present a director of the Berlin Metal Institute, which is established to study the production, treatment, and uses of metals. He is considered to be an authority on the subject of corrosion and its influence on metals.

The problems of corrosion and acid resistivity are closely linked together, stated Dr. Guertler. All natural waters contain salts or acids, and metals in the air are also constantly exposed to corroding influences. The solution of the problem lies in the use of alloys that are made up of solid solutions of resistant crystals.

The eight metals that Dr. Guertler classed as being the chief constituents of all commercial alloys are: magnesium, aluminum, iron, nickel, copper, zinc, lead, and tin. He went on to show how with certain combinations of these metals, for example tin and aluminum, crystals of each metal are always present in the alloy, while with such combinations as those made with copper and nickel, solid solutions are formed in which the crystals are made up of atoms containing each metal.

From our present knowledge of the alloying of metals it is now possible to predict the corrosive resistance of new alloys. All alloys that are not solid solutions should be avoided, continued Dr. Guertler, because the electrolytic action set up in such alloys is destructive. He showed by its molecular construction why an alloy of chromium and iron is resistant to corrosion: Molydenum, also, he stated, imparts a high resistance to oxidation, or rust, in steel. Alloys containing high percentages of nickel, chromium, and molybdenum are now recognized commercially, and will help to solve the previously great problem of loss by corrosion.

New Machinery and Inventions



Illuminating a boiler gage

This device is easily installed and so constructed that vibration does not cause breakage with consequent light failure. Light is thrown on the water gage only, assuring that it may be easily seen.

Puts the Light Where Needed

A boiler-gage light, consisting of a tubular reflector with a bayonet attachment to the socket flange, has been designed and is being manufactured by the Westinghouse Electric and Manufacturing Co. of East Pittsburgh, Pa. A compression spring serves to maintain the connection and to hold the lamp in place, so that neither the reflector nor the lamp can loosen under vibration.

It can be mounted on the guard rail of any boiler water gage or on the end of a ½-in. conduit used to carry wiring to the reflector. This mounting may be accomplished by the use of a screw driver. When it becomes necessary to change the lamp, no tools are needed to remove the reflector because giving it one turn disengages the bayonet attachment, and the lamp can then be taken out.

Light is thrown on the water gage only. The heavy brass reflector is adjustable for any desirable mounting height. Forty-eight inches of two-way conductor cord and an attachment plug are regularly furnished with the boiler-gage light. A standard-tubular Mazda B lamp with T-10 bulb should be used in the socket.

A Low-Power Exhaust Fan with High Efficiency

A new exhaust fan—the Everlasting—has just been introduced by the MacLeod Company, Cincinnati, Ohio. This fan is somewhat different from others in that the material does not come in contact with the impeller. This gives longer life to the fan and keeps it from becoming clogged or out of balance. The material is brought through a projected inlet and discharged at right angles, the wheel being protected by a deflector plate. The only duty imposed on the impeller is the creating of suction by a centrifugal force, the air passing the inlet causing a high suction. This fan, it is claimed, will convey material just as far, produce as strong a suction, and does not require as much horsepower as other fans. The fan is made of blue annealed Armco rust-resisting ingot-iron sheets.

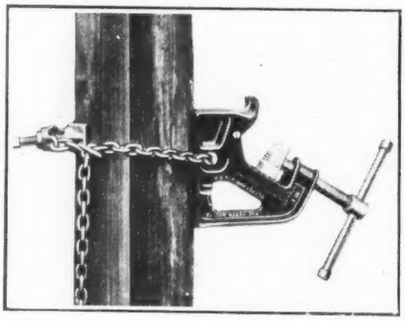
Quick-Acting Side Opening Post or Bench Vise

A new inclined side opening pipe vise which grips and releases the pipe with one turn of the handle and requires less than half the time of the old-type hinged vise is being manufactured by the Oster Manufacturing Co., of Cleveland, Ohio.

It is equipped with oil-tempered, tool-steel jaws so designed that they will grip the pipe securely without danger of squeezing it out of round.

A special chain and clamp for fastening the vice to a post are furnished for use where it is not possible to bolt the vise to the work bench. Another useful accessory is a special eye bolt for pipe bending.

This new vise has an unusually wide range of ⅛- to 2½-in. pipe, the jaws opening wide enough to accommodate a 2-in. coupling so that short nipples can be handled.



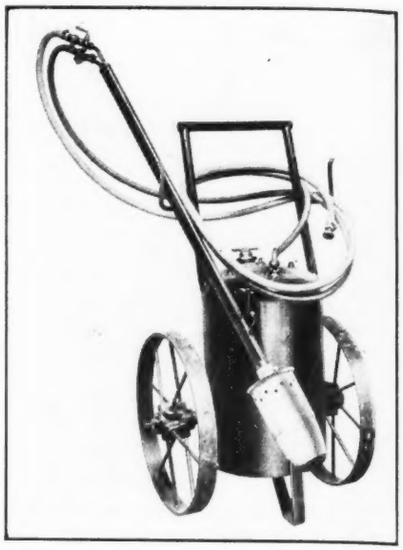
Vise for bench or post

Because this vise can be chained to a post, it is convenient for field work as well as in the shop.

Dangers of Oil Burning Reduced by Suction

Safety as well as efficiency is said to have been achieved in an oil-burning torch recently developed. In this device the principle of oil supply has been changed from pressure to suction feed. No pressure is maintained on the oil-supply tank. This, it is claimed, eliminates the danger of injury to life, and avoids the fire hazard incident to a bursting tank. The danger of the oil spreading in case of a break in the supply line is also avoided.

This device is a product of the Hauck Manufacturing Co., of Brooklyn, N. Y., and is known as the Hauck Venturi suction torch. The company states that its pressure torches may be changed to operation on the suction principle by the attachment to the present oil tank of the suction burner, hose and oil-siphon tube.



Oil-burning torch using suction instead of pressure

This torch will burn 14 ft. above the oil level in the tank. The capacity is from 5 gals. to 20 gals. It is claimed to be much safer than the ordinary torch.

Filtering Air in a New Way

A new air filter that is said to be revolutionary in design and to eliminate many difficulties heretofore found in air filters, has been announced by the American Blower Co., of Detroit, Mich. By means of this new filter, which is of dry plate design with hair-like tentacles for the arresting and retention of dust and dirt, dust-laden air is divided into a series of small jets, which strike the flat filament-coated surface of the plates; dust and soot are projected against the filament, seized, and retained. The air, changing its direction and rebounding from this surface, flows through to the next plate and is carried through ten successive dust-removal operations of this type. As dust builds up on these flat surfaces, each preceding layer acts as a retentive member, the dust itself being the principal dust-arresting and retaining factor for the ensuing particles of dust and dirt. In this way, the use of adhesives is avoided and the maximum load of a cleaner or filter is multiplied many times.

The outstanding advantages of this type of air filter are said to be that it is impossible to clog the filter, that it does not require oil or other adhesives which have to be changed from time to time, that it has a constant effect and constant efficiency, and that dust builds upon dust and does not get in the line of air flow.

Catalogs

Coal Crushers — A bulletin of the American Pulverizer Co., St. Louis, covers American ring coal crushers.

Bearings—Bulletin 1560, issued by the Hyatt Roller Bearing Co., Newark, N. J., contains data for engineers and draftsmen concerned with designing plant and producing equipment. It includes formulas for determining bearing sizes for specific applications.

The Market Report

Better Business in Copper

New York, Nov. 10—Sentiment in the metal markets seems somewhat improved over that of a week ago. After three dull weeks copper sales have picked up materially. Zinc had another extremely active week and lead has been selling in moderate volume, at steady prices. Both copper and zinc sagged during the week, but the markets have a firmer appearance today. Tin is inactive, with higher prices for spot; silver is dull and steady; quicksilver and antimony are firm.

Copper Below 13.875c.

After three weeks the copper market has shown signs of life, and the volume of business during the week ending today has been good. Since Monday concessions from the 13.875c. level have been made by two sellers, but sales also have been made each day on the basis of 13.875c. delivered in Connecticut. Prices for a moderate "Middle West" business ranged from 13.95c. to 14.075c. delivered.

Last Friday Copper Exporters, Inc., reduced its "foreign" from 14.40 c.i.f. to 14.25c. This presumably is in line with the policy of the association to keep the spread between foreign and domestic prices within reasonable limits. They do not want foreign fabricators to feel that they are being discriminated against. Sales for export, particularly to Germany, have been encouragingly large, both before and since the reduction in the official price.

Daily Prices of Metals

Nov.	Copper N. Y. net refinery	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
4	13.65	67.00	69.00	8.00	7.80	7.20
5	13.625	67.00	69.00	8.00	7.75@7.80	7.15@7.20
6	13.65	67.625	69.625	8.00	7.75@7.80	7.20
8	13.575	67.75	69.75	8.00	7.775@7.80	7.20
9	13.60	68.75	70.75	8.00	7.775@7.80	7.20
10	13.60@13.625	68.25	70.25	8.00	7.775@7.80	7.20@7.225
Av.	13.619	67.729	69.729	8.000	7.785	7.198

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

Nov.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
4	57½	58⅜	66½	300½	293½	29 7/16	29 9/16	33 5/16	33¼
5	57¼	58	65¾	298½	291¼	29	29¼	32 15/16	33
8	57⅛	58	65¾	303	292¾	29 1/16	29 5/16	32⅞	33
9	57⅝	58½	65¾	309¾	297¾	29 5/16	29 9/16	33 3/16	33 5/16
10	57¾	58⅝	65¾	311½	299¾	29⅜	29 11/16	33⅜	33 7/16

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Nov.	Sterling Exchange "Checks"	Silver		Gold London	Nov.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
4	4.84	53	24 11/16	84s11½d	8	4.84¼	53½	24 15/16	84s11½d
5	4.84	52⅞	24⅝	84s11½d	9	4.84¼	53⅜	24⅞	84s11¼d
6	4.84¼	53	24¾		10	4.84¼	53⅜	24 13/16	84s11½d

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-half cent premium.

Lead Holds Steady

No further reductions have been made in contract prices for New York lead by the American Smelting & Refining Co., the 8.00c. quotation applying throughout the week, not only on sales made by the Smelting company but on business placed by other sellers also. A few carloads were sold in the East by Middle Western producers, on which a premium of about ten points was secured, but in such instances a particular brand was desired. The market is steady at the current level, and, with somewhat better reports coming from abroad, market observers believe the bottom for the declining movement may have been reached. This is not to say that any immediate advance is anticipated.

Most of the business during the week ending today has been in the Middle West, where sales have been very satisfactory by practically all producers. A fair tonnage was sold at both 7.75 and 7.80c., St. Louis, early in the week, but in the last two or three days nothing under 7.775c. has been reported; one large seller has been firm at 7.80c. all week. Corroders have been in the market, and the storage-battery makers have been buyers, though one or two seem to be feeling the dullness occasioned by diminished Ford production.

Another Big Week for Zinc

Zinc buying has been active all week, with prices ranging from 7.15c. up to 7.22½c. A few small lots brought 7.125c. The price today is 7.22½c. for immediate delivery, with futures at 7.20c. High Grade is dull at 9.25c. New York. Statistics for October just issued by the American Zinc Institute follow:

Stock Oct. 1	15,699
Produced	54,979
	70,678
Shipped	54,769
Stock Oct. 31	15,909
Shipped from plant for export	4,160
Stored for customers	50
Retorts operating Oct. 31	87,028

Tin Still Unbalanced

Tin for early delivery continues so scarce that the market is difficult to quote, spot tin, in some instances, commanding a premium of about 1c. over tin for shipment in a few days. The prices quoted in the table on page 793 represent an average of the business actually done for spot and ex-steamer at dock. Consumers and dealers have bought in small quantities, largely for immediate needs. February deliveries are offered at discounts of 4 to 5c. from prompt.

Silver 53⅜c.

Silver fluctuated within relatively narrow limits during the last week, and the premium on London spot quotations over forward indicates a scarcity of ready supplies in that market. India is a somewhat better buyer at current levels, both for shipment and to cover open short positions, which gives the market a steadier appearance, although business is still generally quiet. China is not much of a factor at the moment, and there are no features of special interest.

Mexican Dollars: Nov. 4th, 40¼c.; 5th, 40⅜c.; 6th, 40¼c.; 8th, 40⅝c.; 9th and 10th, 40½ cents.

Foreign Money Unchanged

Foreign exchange quotations in general show little change from last week. Closing cable quotations on Tuesday, Nov. 9, were as follows: francs, 3.175c.; lire, 4.18c.; and marks, 23.74c. Canadian dollars, 9/64 per cent premium.

Other Metals

Quotations cover large wholesale lots unless otherwise specified. London prices are according to latest mail advices.

Aluminum—Both 98 and 99 per cent grades quoted at 27c. per lb. London, £107 per long ton for domestic metal.

Antimony—Per lb., duty paid, New York: Chinese brands, spot 13⅛c.; December 13c. Cookson's "C" grade, 17⅛c. Needle and oxide nominally unchanged from quotations in the Nov. 6 issue.

Bismuth—Per lb., New York, in ton lots, $2.70@$2.75. London, 10s.

Cadmium—Per lb., New York, 60c. London, 1s. 10½d. for American metal; 1s. 9d. for Australian metal.

Iridium—Per oz., $120@$125 for 98 @99 per cent sponge and powder. Firm. London, £32½ in iridio-platinum; £18@ £22 for sponge and powder. Nominal.

Nickel — Per lb., ingot, 35c.; shot, 36c.; electrolytic, 39c. (99.75 per cent grade). London, £170@£175 per long ton according to quantity.

Osmium—Per oz., $55@$60. London, £16@£19.

Palladium—Per oz., $66@$70. Pure metal as a constituent of crude platinum, $55@$60 per oz. London £11@ £13, nominal.

Platinum — Official price on refined metal, $112 per oz. Open market cash sales of large lots, $107. Pure metal as a constituent of crude platinum, $105. Market dull.

London, £23 per oz. for refined and £20½ for crude.

Quicksilver — Per 75-lb. flask, $98.50 @$99.50. San Francisco wires $98.33, steady. London, £16½.

Ruthenium—Per oz., nominally $45@ $50. London, £7½@£11.

The prices of **Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Monel Metal, Radium, Rhodium, Selenium, Tantalum, Tellurium, Thallium, Tungsten,** and **Zirconium** are unchanged from the issue of Nov. 6.

Metallic Ores

Manganese Ore—Per long ton unit of Mn, c.i.f. North Atlantic ports, minimum 47 per cent Mn, 30c. Caucasian (washed), 53@55 per cent, 34@40c. The market is firmer on account of smaller imports.

[1]Chemical grades, powdered, coarse or fine, 82@87 per cent MnO_2, Brazilian and Cuban, $70@$80 per ton in carloads.

Tungsten Ore — Per unit of WO_3, N. Y.: Wolframite, $10.50@$10.75; Western scheelite, $11@$11.25. Dull.

Chrome, Iron, Molybdenum, Tantalum, Uranium, and **Vanadium Ores** are unchanged from quotations in the Nov. 6 issue.

Lead Ore Unchanged—Zinc Blende Lower

Joplin, Mo., Nov. 6, 1926.

Blende	
High	$52.00
Premium blende, basis 60 per cent zinc	$48.00@49.00
Prime Western, basis 60 per cent zinc	47.00
Fines and slimes, 60 per cent zinc	46.00@44.00
Average settling price, all zinc	47.74
Galena	
High	$105.60
Basis 80 per cent lead	100.00
Average settling price, all lead	104.19

Shipments for the week: Blende, 17,990; calamine, 70; lead, 2,247 tons. Value, all ores the week, $1,094,650.

One buyer of lead announced a cut of $5 in offerings for lead concentrate, placing the price at $95 basis, but other buyers continued offerings as last week on $100 basis, and this was later accepted as price for the week. There was very slow selling even with the price unchanged. Stock is reported around 10,300 tons. The shipment this week was 1,190 less than last.

Zinc shipments are covering the tonnage of output at present. The $1 cut in price offerings today was generally accepted for the output tonnage of this week.

A number of mines have signified an intention of taking a week off Thanksgiving week; others expect to discontinue production for a half week.

Platteville, Wis., Nov. 6, 1926

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc	$50.75
Lead Ore	
Lead, basis 80 per cent lead	$100.00

Shipments for the week: Blende, 1,346 tons; lead, none. Shipments for the year: Blende, 47,835; lead, 1,686 tons. Shipments for the week to separating plants, 2,181 tons blende.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fuller's Earth, Fluorspar, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Ilmenite, Iron Oxide, Lepidolite, Limestone, Magnesite, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystals, Silica, Spodumene, Sulphur, Talc, Tripoli, and **Zircon** are unchanged from prices in the Nov. 6 issue.

[1]Price furnished by Foote Mineral Co., Philadelphia.

Mineral Products

Arsenious Oxide (White Arsenic)—3½c. per lb. for deliveries up to July, 1927. London, £15¾@£16½ per long ton.

Calcium Molybdate, Copper Sulphate, Sodium Nitrate, Sodium Sulphate (Salt Cake), and **Zinc Oxide** are unchanged from prices in the Nov. 6 issue.

Ferro-Alloys

Ferromanganese — Domestic, 78@82 per cent, $100 per long ton, furnace, for prompt. No offers for future. Sellers bullish. Spiegeleisen unchanged from Nov. 6 issue.

Ferrocerium, Ferrochrome, Ferrophosphorus, Ferrosilicon, Ferrotitanium, Ferrotungsten, Ferro-uranium and **Ferrovanadium** are unchanged from prices in the Nov. 6 issue.

Metal Products

Rolled Copper — Sheets, 22¼c.; wire, 16c. per lb., f.o.b. mill.

Lead Sheets—Full rolled, 12c. per lb.; clipped, 12¼c.

Nickel Silver—29¼c. per lb. for 18 per cent nickel Grade A sheets.

Yellow (Muntz) Metal — Dimension sheets, 19⅞c. per lb.; rods, 16⅞c. per lb.

Zinc Sheets — 11¾c. per lb., f.o.b. works.

Refractories

Fireclay Brick, Chrome Brick, Magnesite Brick, Silica Brick and **Zirkite** are unchanged from quotations in the Nov. 6 issue.

Steel and Pig Iron Firm—Coke Easier

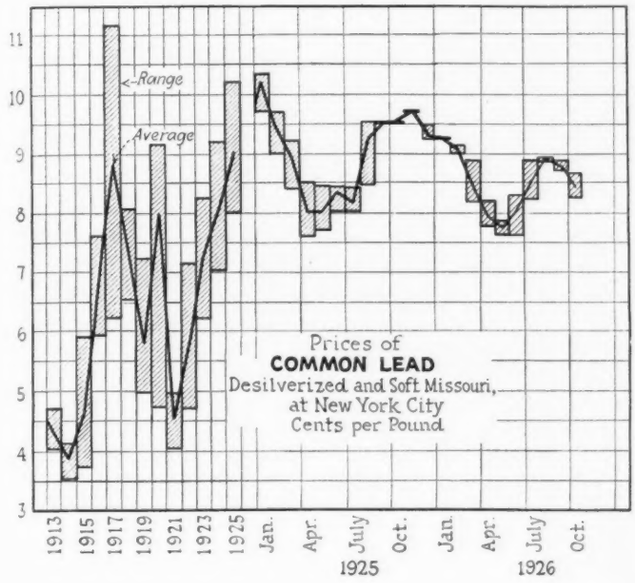
Pittsburgh, Nov. 9, 1926

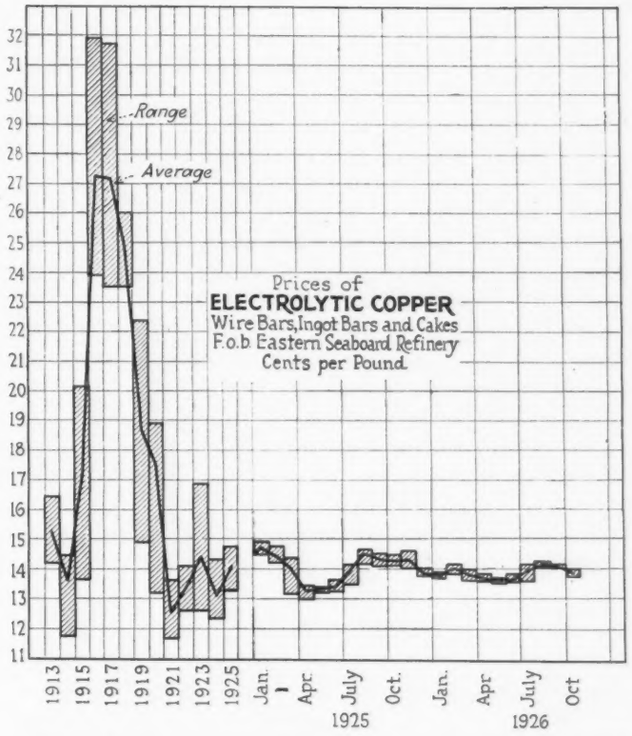
The volume of steel buying has continued to decrease, but the total decrease since the turn of about a month ago is not large, the market on the whole being fairly active. The decreases come from a combination of circumstances, largely of temporary influence, not seriously impairing the general prospects for the new year. There is the usual seasonal decrease in consumption in various lines, which works out in lighter buying, since the hand-to-mouth policy is everywhere in evidence.

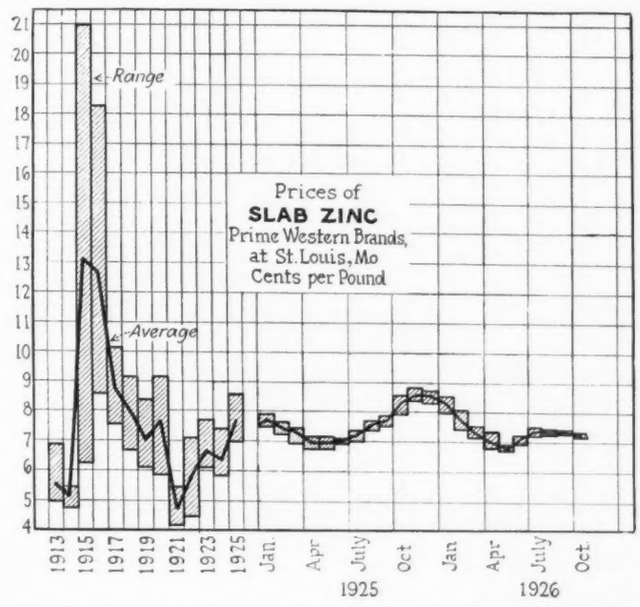
Pig Iron—The dollar a ton advance in asking prices has chilled inquiry, which was not heavy at any time. The market range, between prices recently done and present asking prices is: Bessemer, $19.50@$20.50; basic, $18.50 @$19.50; foundry, $19@$20, f.o.b. valley furnaces.

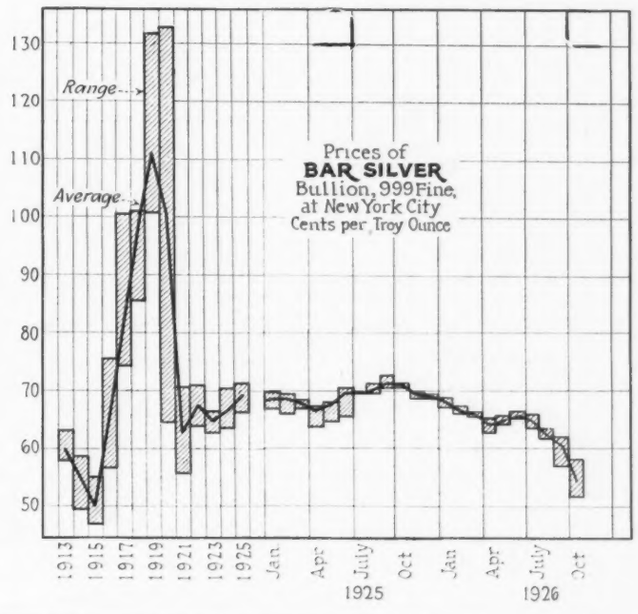
Connellsville Coke — Offerings are light, but demand is lighter and spot prices are beginning to show a softening tendency, with furnace at $5@$5.25 and foundry at $6@$6.50. Production is expected to increase with the wage advance of Nov. 1 and the lower prices now ruling for coal.

Metal Price Curves

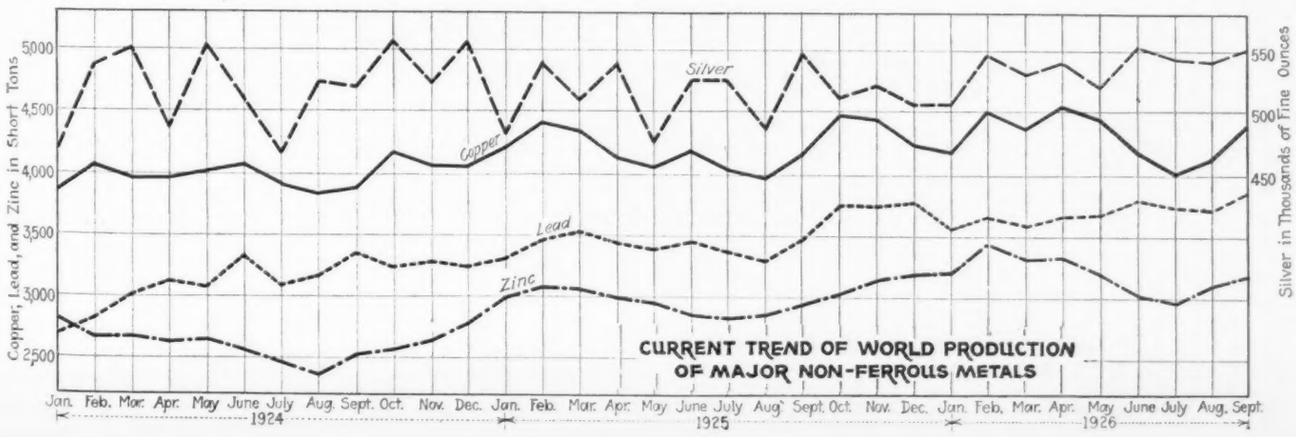



Range
Average
Prices of
ELECTROLYTIC COPPER
Wire Bars, Ingot Bars and Cakes
F.o.b. Eastern Seaboard Refinery
Cents per Pound
1913 1915 1917 1919 1921 1923 1925 Jan. Apr. July Oct. Jan. Apr. July Oct.
1925 1926





THE curves below are not to be considered as permanent records of production. They show merely the current trend in terms of daily output, according to latest estimates of the American Bureau of Metal Statistics. The figures represent countries that produced in 1924 and 1925 about 97 per cent of the world's output of copper; 78 per cent of the lead; 87.5 per cent of the zinc; and 81 per cent of the silver.


Silver
Copper
Lead
Zinc
Copper, Lead, and Zinc in Short Tons
Silver in Thousands of Fine Ounces
CURRENT TREND OF WORLD PRODUCTION
OF MAJOR NON-FERROUS METALS
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept.
1924 1925 1926

Review of Current Statistics

By A. B. Parsons
Assistant Editor

SILVER, as was the case a month ago, must bear most of the responsibility for the drop from 109.27 to 106.20 in the *E. & M. J.* Weighted Index of Non-Ferrous Metal Prices during October. Just over 50 per cent of the decline is chargeable to silver, 25 per cent to lead, and 20 per cent to copper. Tin prices averaged higher during October than during September, whereas aluminum and nickel showed no change. Even if silver had picked up to 65c. per ounce, instead of declining from 60.580c. in September to 54.505c. in October, there would have been a decline in the Index Number. This fact is significant because it shows that the weakness is not confined to silver.

At the same time the position of metals with respect to other commodities is not unfavorable, at the moment, as indicated in the graph at the bottom of this page. Since August, 1925, metal prices have been measurably above the "all-commodity" index and the spread is still close to the average during the period. However, the downward tendency of metal prices that started in September and continued in October has persisted thus far (Nov. 10) in the present month; and, unless the trend is reversed quickly and sharply, November will show a decline over October.

There seems to be general agreement that a peak of industrial activity has been passed and that a slacking is at hand, though opinions differ as to the magnitude of the depression. Possibly it will be only a brief breathing spell to be followed by early advances. According to the *Electrical World* Barometer of Industrial Activity, which is based on the consumption of electric energy in 1,700 large manufacturing plants all over the United States, metal and textile operations were increasingly active in October, whereas all others, including ceramics, automotive, and lumber, decreased. Incidentally the status of the metal-manufacturing industries reflected by these figures is contradictory to the conclusions of the iron-trade periodicals, which generally find a slowing up.

Perhaps it is far-fetched to interpret the decline in the Non-Ferrous Metal Index as forecasting in September the contraction in industrial activity that is expected in November. At any rate, if the decline in copper, lead, and zinc prices reflected a shrinkage in the forward orders on the books of metal-consuming manufacturers, the value of the Metal Index as a dumb prophet is suggested. Admittedly the factors involved are many and complex; yet the trend is worth studying.

Strong competition developing between the big producers of borax has resulted in a cut of about ¾c. per pound in all grades of borax. This has been the predominant factor in reducing the sensitive Weighted Index of Non-Metallic Mineral Prices from 105.81 to 104.58. Magnesite is off slightly, and feldspar prices are somewhat stronger; otherwise no quotable changes in prices developed during October.

E.&M.J. Weighted Index of Non-Ferrous Metal Prices

100 Is Composite for 1922-3-4

1920	130.92
1921	80.80
1922	93.94
1923	103.43
1924	102.63
1925	134.38
Average 10 months, 1925	111.00
Average 10 months, 1926	108.63

	1925	1926
April	104.75	105.93
May	105.34	105.43
June	107.19	106.68
July	108.81	109.08
August	113.61	110.22
September	114.66	109.27
October	115.64	106.20

Shares of mining companies suffered a decline during October, but they did not fare as badly as the general industrial list. The following tabulation shows the course taken by Irving Fisher's fifty most active industrials and the three groups included in the graphs on page 797:

	Fifty Active Industrials	A—Smelting, Manufacturing	B—Copper	C—Gold, Silver Lead, Zinc
Last week of September	178.9	146.0	105.6	163.1
Last week of October	162.1	141.4	105.1	158.5
Decline, per cent..	9.5	3.1	0.5	2.8

Each of the seven companies in Group A declined except New Jersey Zinc, which remained unchanged. It, incidentally, suffered a $17 drop to $191 during September. The order in which the other companies contributed to the decline in October is: American Smelting & Refining, Anaconda, American Metal, National Lead, U. S. Smelting, Refining & Mining, and International Nickel. The collapse of the silver market doubtless had some influence on all but National Lead and International Nickel.

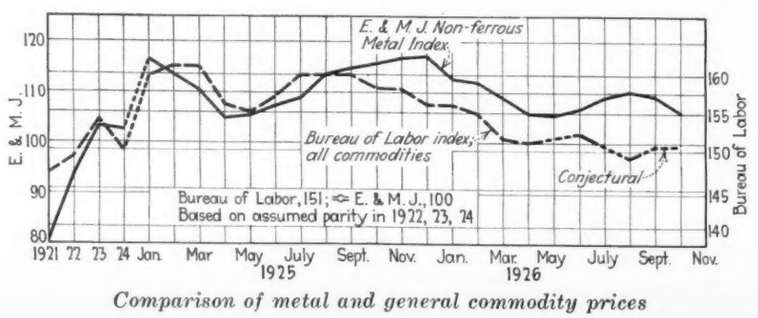
The comparative strength of the copper shares, Group B, is accounted for by the fact that in several instances the market advanced. Nevada Consolidated —which of course includes Ray and Chino—was the leader, with an advance of $2 to $15¾. New Cornelia, Inspiration, and Miami also contributed to the increase. Possibly there is some significance in the fact that none of these companies mines ore that contains important quantities of silver. No large individual declines are noted.

In Group C, Federal M. & S. Co. and three gold producers—Homestake, Lake Shore, and Cresson—showed improvement. One worry from which the gold producers are free is the market price for their output. With a gradual decline in general commodity prices, which necessarily is reflected ultimately in lower operating costs, the position of gold mines is improving. Hollinger took a decided drop, for causes that must be purely local. Cerro de Pasco, Utah-Apex, Premier, Howe Sound, and Tintic Standard all tumbled. A glance at the list of the world's leading silver-producing companies will reveal the principal reason for these declines. Taken all in all, however, the mining stocks did very well in October compared with the general share list.

Tonnage statistics for production, shipments, and stocks of the major non-ferrous metals are mixed in significance. Unfortunately, none of them are more recent than Sept. 30, and in critical times a month may make lots of difference. As shown in the curves at the bottom of page 795, September production rates were all higher than those of August. In the instance of silver, the rate approximately equals the maximum reached several times during the last two years; and as for lead, world's production appears to be at a higher rate than ever before. It should not be overlooked that the data shown in the curves are daily averages; and that September increases may have been magnified by the policy of some companies to keep the monthly output up regardless of the fact that the month is one of only thirty days.

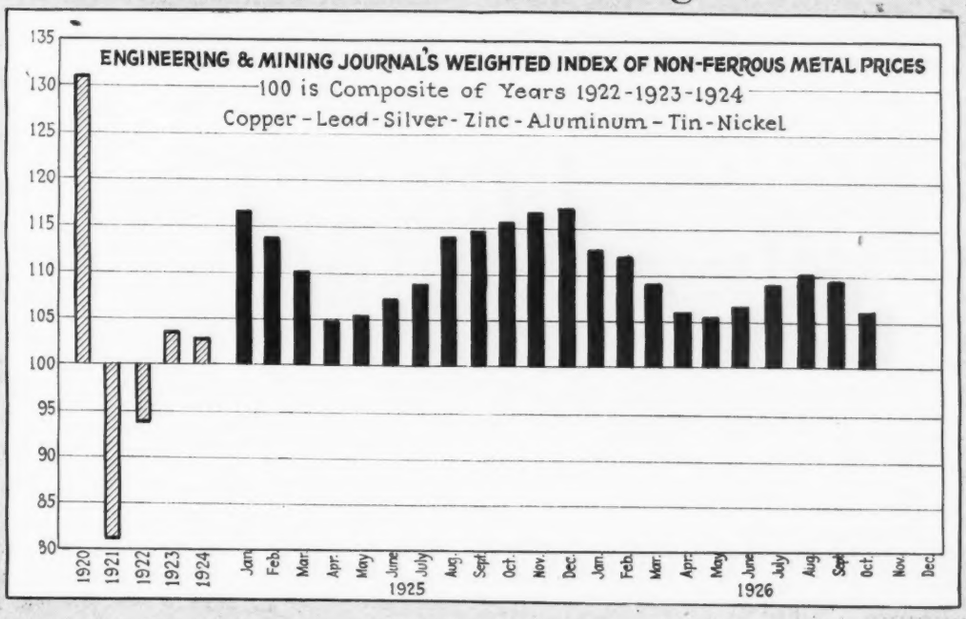
The most recent available figures show a decline in stocks of lead at smelters in the United States and Mexico as of Aug. 31; however, this tendency is likely to be reversed when the September figures appear.

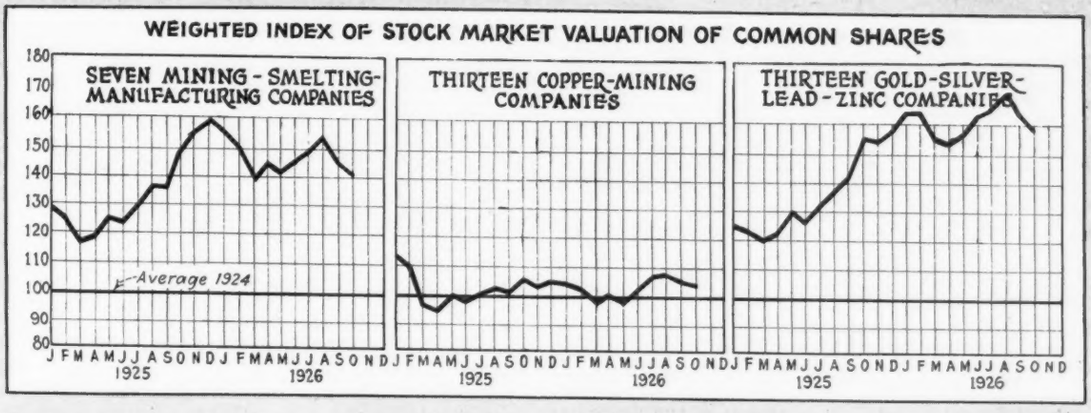
Statistically, zinc seems to be in an excellent position, with a decline in stocks for each of the four months ending with Sept. 30. However, production has remained at a high rate, and with exports sagging, the domestic market may find difficulty in absorbing current output. Little change in the copper situation is disclosed by September data.

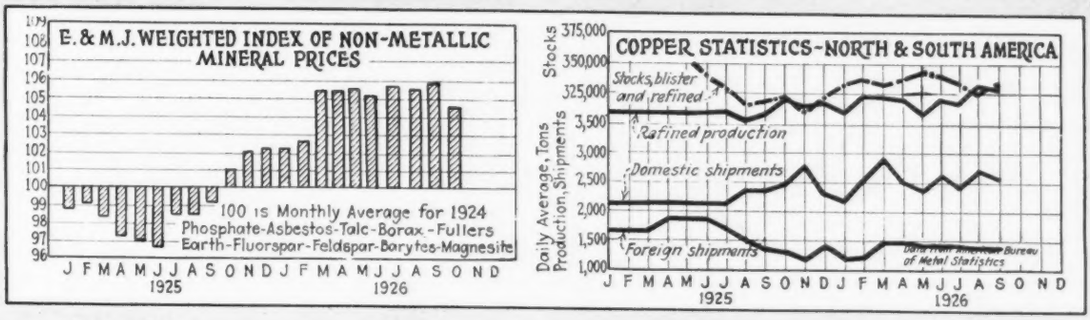


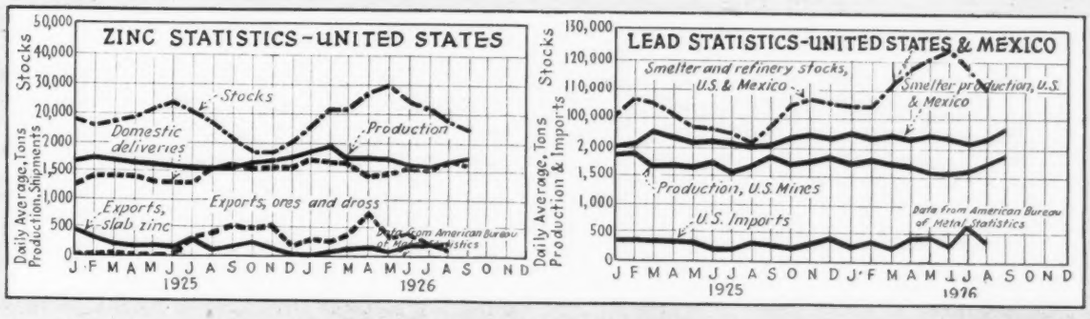
Comparison of metal and general commodity prices

E.&M.J. Statistics of the Mining Industries


ENGINEERING & MINING JOURNAL'S WEIGHTED INDEX OF NON-FERROUS METAL PRICES
100 is Composite of Years 1922-1923-1924
Copper - Lead - Silver - Zinc - Aluminum - Tin - Nickel
1920 1921 1922 1923 1924 Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
1925 1926


WEIGHTED INDEX OF STOCK MARKET VALUATION OF COMMON SHARES
SEVEN MINING - SMELTING-MANUFACTURING COMPANIES
THIRTEEN COPPER-MINING COMPANIES
THIRTEEN GOLD-SILVER-LEAD - ZINC COMPANIES
Average 1924
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1925 1926


E. & M.J. WEIGHTED INDEX OF NON-METALLIC MINERAL PRICES
100 is Monthly Average for 1924
Phosphate-Asbestos-Talc-Borax-Fullers Earth-Fluorspar-Feldspar-Barytes-Magnesite
J F M A M J J A S O N D J F M A M J J A S O N D
1925 1926
COPPER STATISTICS - NORTH & SOUTH AMERICA
Stocks
Stocks, blister and refined
Refined production
Domestic shipments
Foreign shipments
Daily Average, Tons Production, Shipments
Data from American Bureau of Metal Statistics
J F M A M J J A S O N D J F M A M J J A S O N D
1925 1926


ZINC STATISTICS - UNITED STATES
Stocks
Stocks
Domestic deliveries
Production
Exports, slab zinc
Exports, ores and dross
Daily Average, Tons Production, Shipments
J F M A M J J A S O N D J F M A M J J A S O N D
1925 1926
LEAD STATISTICS - UNITED STATES & MEXICO
Stocks
Smelter and refinery stocks, U.S. & Mexico
Smelter production, U.S. & Mexico
Production, U.S. Mines
U.S. Imports
Daily Average, Tons Production & Imports
Data from American Bureau of Metal Statistics
J F M A M J J A S O N D J F M A M J J A S O N D
1925 1926

Company Reports

International Nickel Netted $4,089,122 in Nine Months

The International Nickel Co. reports for quarter ended Sept. 30, 1926, net profit of $1,314,432 after depreciation, depletion, federal taxes, and other charges, equivalent after preferred dividends to 70c. a share (par $25) earned on 1,673,384 shares of common stock. This compares with $1,408,116 or 76c. a share in preceding quarter and $1,421,118 or 76c. a share in third quarter of 1925.

Net profit for first nine months of 1926 totaled $4,089,122 after above charges, equal to $2.20 a share on common, against $4,005,318, or $2.14 a share in same period of previous year.

The consolidated income accounts for quarters ended Sept. 30 compare as follows:

	1926	1925	1924
Earnings	$2,002,612	$2,123,487	$894,202
Other income	41,679	23,324	34,791
Total income	$2,044,291	$2,146,811	$928,993
Expenses	127,476	149,290	90,428
Federal taxes	193,205	220,951	85,526
Depreciation, depletion	409,178	355,452	317,282
Net profit	$1,314,432	$1,421,118	$435,757
Preferred dividends	133,689	133,689	133,689
Common dividends	836,692	836,692	.....
Surplus	$344,051	$450,737	$302,068

Corresponding figures for nine months ended Sept. 30 follows:

	1926	1925	1924
Earnings	$6,270,189	$5,897,536	$2,500,588
Other income	127,567	138,012	154,026
Total income	$6,397,756	$6,035,548	$2,654,614
Expenses and federal taxes	1,076,983	964,389	477,396
Depreciation and depletion	1,231,651	1,065,840	963,166
Net profit	$4,089,122	$4,005,319	$1,214,052
Preferred dividends	401,067	401,067	401,067
Common dividends	2,510,076	836,692	.....
Surplus	$1,177,979	$2,767,559	$812,985

Texas Gulf Sulphur Earnings Increase

The Texas Gulf Sulphur Co., reports for the quarter ended Sept. 30, 1926, net earnings of $2,531,468 after depreciation and federal taxes, but before depletion, equivalent to 99c. a share earned on 2,540,000 shares of no par stock. This compares with $1,859,918, or 73c. a share, in the preceding quarter and $1,478,846, or 58c. a share, on the present share basis in the third quarter of 1925.

Net earnings for the first nine months of 1926 totaled $6,322,010 after above charges, before depletion, equal to $2.48 a share, against $4,174,223, or $1.64 a share, on present capitalization in same nine months of previous year.

During the last quarter the company increased its reserves, including reserves for depreciation and accrued unpaid federal taxes, by $520,451, making total of these reserves $7,423,814.

The statement for the quarter ended Sept. 30 compares as follows:

	1926	1925	1924
Net earnings (*a*)	$2,531,468	$1,478,846	$1,140,219
Dividends	1,905,000	1,270,000	1,111,250
Surplus	$626,468	$208,846	$28,969
Profit and loss surplus (*b*)	8,482,286	7,471,509	7,199,879

(*a*) After depreciation and federal taxes. (*b*) Includes reserve for depletion.

According to official figures from the State of Texas, the Texas Gulf Sulphur Co. produced 344,782 tons of sulphur in the quarter ended Sept. 30. This, perhaps, is the largest output since the company began business, and was at the rate of 1,380,000 tons annually.

It is evident from these figures that the company must have added heavily to its stockpiles in the third quarter. Had the sulphur produced in the third quarter all been sold and shipped, earnings would have been much larger than the 99c. a share reported on the 2,540,000 shares outstanding.

It is believed that the company must have added something like $2,000,000 worth of sulphur to its stockpiles in the third quarter, these figures being based on the price of sulphur at the mine. As the sulphur comes out of the ground almost pure, the only additional cost after it flows on the pile is for blasting and loading on cars.

Estimates of stocks on hand range between 2,000,000 and 2,600,000 tons. Taking the middle figure, 2,300,000 tons, its value, based on price at the mine, would exceed $45,000,000. This is the big asset of the company, and one of the main reasons for the price at which the stock is selling.

Mexico Cuts Tax on Silver Production

In an effort to offset the handicap to Mexico's mining industry by reason of the recent slump in the price of silver, President Calles has approved a decree reducing for six months state and federal taxes on silver production, according to advices from Mexico City. The present regulation provides a normal tax of 5 per cent when the New York price is 60c. per ounce or under.

The decree provides that when the New York price is 45c. or less per ounce the production tax by the federal government will be one-half of 1 per cent, and the state tax the same. An increasing scale of taxation is provided as silver prices advance, until the value reaches 57c. an ounce, when the federal tax will be 4.25 per cent and the state tax 2 per cent.

Following immediately on the heels of the exchange crisis which is not yet terminated, Mexico has been badly hit by the silver situation, to such an extent that well-informed financial circles are occupied by the question of whether the combination may eventually affect the government's financial stability, says a dispatch to the *Wall Street Journal*.

Recently no official statements, the article continues, have been issued regarding government economies, all having been busy with the problem of seeking a solution for the admittedly grave mining situation, and there has been no hint that Mexico will not be able to keep pace with international obligations. In considering the present situation, it must be remembered that Mexico's main incomes arise from oil and mining, and world factors such as the silver crisis, together with such an uncertain proposition as petroleum production, are naturally food for constant official study.

It is generally accepted that the government has reached a basis regarding mining taxation that will enable large foreign interests at least to keep going and thus avoid permanent damage to the industry. With foreign obligations on such a favorable basis as arranged by Finance Minister Pani with the International Committee of Bankers on Mexico under which the National Railway obligations became autonomous, thus relieving the treasury of practically half its national indebtedness, little fear is held that the monthly deposits which have been so far regularly made on foreign debt will be discontinued, but when interest will begin to be paid on the railway obligations would appear to be still problematical. Despite the recent inundations, which caused heavy damage, railway receipts are claimed to have increased, but when repair work is all paid for the system will probably find that expenses have been large.

The government statistical department has completed details regarding Mexican production of gold, silver, and other metals for the first eight months of the current year. Gold produced was 15,903 kg., March being the best month with 2,290. Silver mined was 1,922,610 kg., and March again was the best month with 285,917. Lead production was 136,488,087 kg., and copper reached 31,896,825. Zinc production was 63,786,370 and mercury totaled 3,027 kg.

Some Reassurance in the Silver Situation

The *London Financial Times*, a publication whose editor is E. Hilton Young, who served as chairman of the late Royal Commission on Indian Currency and Finance, in a recent number has an editorial in which the opinion is expressed that certain misconceptions about the recommendations of the commission relative to silver prevail in the United States, to wit (1) that "a slow demonetization of silver will result from the proposal that the coinage of silver shall be stopped for a long time to come until the amount of silver in circulation is reduced to the amount required for small change, and (2) that the commission's recommendations involve the sale of 250,000,000 oz. of silver in ten years."

The editorial comment upon the first quotation is as follows:

"As recently pointed out, the stoppage in the coinage of silver does not result from any recommendation of the commission. The Government of India had 90 crores of surplus rupees when the commission was constituted. The stoppage is the result of the vast supplies of silver rupees that had to be put into circulation during the war. To refer to the amount required 'for small change' in India is misleading. The rupee is, and is to remain, the only metallic currency. For generations to come it may be expected to be required, not only as small change, but as a principal medium of exchange."

Commenting on the situation the National City Bank of New York says that this is quite definite as an expression of the opinion of the chairman of the commission. Evidently, he holds that the people of India will be slow to abandon their preference for the silver rupee as the money of common circulation. As to the "misconception" prevailing in the United States, however, it would appear to be partly justified by the following language, on page 29, volume I, of the commission's report:

"Our recommendation implies that the coinage of silver rupees should be stopped for a long time to come, until the amount of silver rupees in circulation is reduced to the amount required for small change."

It is true that the report of the commission has not been translated into law, and probably it is also true, as the chairman seems to assume, that the Government of India will continue to coin rupees as long as the public expresses a preference for that form of currency. The commission recommends that no legal obligation to convert paper currency into silver rupees shall attach to new issues of currency, but advises that facilities for such conversion shall be afforded as long "as the public desires to obtain silver rupees."

As to the second "misapprehension," the report says, paragraph 80:

"We therefore make a recommendation (paragraph 145 below) which will have the effect of ensuring the gradual reduction of the silver holding in the reserve, during a transitional period of ten years, from the present figure of Rs. 85 crores, to Rs. 25 crores on the basis of the present circulation."

The chairman's comment upon this is that

"the recommendations provide for the avoidance of any such sale by the absorption of surplus silver into circulation in the normal course of expansion of trade."

It is obviously true that if in the course of ten years the surplus reserves of silver above 25 crores have been absorbed into circulation by the growing volume of business there will be no silver for sale. According to the chairman this is the expectation of the commission.

It is of course true that the government's present reserves of silver are unnecessarily large. They must be regarded as resulting from the extraordinary purchases of the government under the Pittman Act. With the lower level of prices now prevailing less currency is needed in circulation and it accumulates in the reserves. Unless there was a prospect of its reabsorption into circulation within a reasonable time, the government naturally would want to dispose of it, but it may be regarded as quite probable that no sales ever will be necessary.

The *London Financial News*, another financial journal, expresses the opinion that the importance of the Indian Commission's recommendation as to silver has been exaggerated. It does not believe that a paper currency can be substituted for the silver currency to which the people of India have been so long accustomed, but holds that if accomplished such substitution will be a very slow process and that the increasing currency requirements will be likely to neutralize in whole or in part the effects of whatever substitution occurs. This view seems to be concurred in quite generally in circles well informed upon India.

Imports and Exports of Ores and Metals in September, 1925 and 1926

Compiled from U. S. Department of Commerce Records

In pounds unless otherwise stated

Imports

	September, 1925	September, 1926
Antimony		
Ore, gross weight	377,028	612,759
Ore, antimony content	235,846	317,927
Liquated regulus or metal	846,220	2,265,353
Copper		
Ore	4,806,437	15,939,601
Concentrates	3,790,728	3,205,304
Regulus, coarse metal, cement copper	82,874	7,407
Imported from:		
Spain	603,893	852,958
Canada	1,969,139	6,724,283
Mexico	1,926,541	2,290,604
Cuba	1,859,200	2,107,898
Chile	1,827,123	5,199,064
Peru	161,447	105,578
Other countries	332,696	1,871,927
Unrefined black, blister and converter copper in pigs, bars, and other forms	33,630,727	55,299,075
Imported from:		
Spain	3,333,870	6,503,116
United Kingdom	76,965	11,486,400
Canada	5,444,692	4,192,906
Mexico	3,267,773	7,384,290
Chile	5,071,268	5,161,131
Peru	6,989,323	6,331,720
Portuguese Africa	6,087,001	5,268,083
Other countries	3,359,835	8,971,429
Refined copper	10,034,901	13,296,361
Old and clippings for remanufacture	848,658	543,307
Composition metal, copper chief value	20,430	15,084
Brass		
Old and clippings for remanufacture	1,345,454	557,347
Lead		
Ore and matte	5,405,859	11,411,868
Bullion or base bullion	12,229,738	22,004,352
Pigs and bars	14,208	1,206,721
Scrap lead, babbitt metal, solder and other forms	129,472	160,414
Type metal and antimonial lead, gross weight	112,131	199,915
Type metal and antimonial lead, lead content	99,797	288,013
Manganese ore, tons, Cuba, gross weight	92	4,814
Manganese ore, tons, Other countries manganese content	22,709	18,167
Pyrites, tons	23,844	23,867
Tin		
Ores, tons	28	13
Bars, blocks and pigs	12,029,750	13,646,182
Imported from		
United Kingdom	3,427,791	4,114,925
British Malaya	7,561,692	7,794,346
China	.....	224,000
Dutch East Indies	58,400	.....
Hongkong	45,179	.....
Australia	179,200	224,000
Other countries	757,488	1,288,911
Zinc		
Ore, zinc content, Free	.....	.....
Ore, zinc content, Dutiable	318,433	1,429,735
Blocks, pigs and old	5,962	13,436

Exports

	September, 1925	September, 1926
Copper		
Ores, concentrates, composition metal and unrefined	325	695,865
Refined in ingots, bars and other forms	61,808,171	70,534,504
Exported to		
Belgium	5,908,593	5,720,114
France	9,569,644	11,946,234
Germany	13,667,803	13,925,478
Italy	7,614,026	5,213,857
Netherlands	3,050,486	5,088,345
Spain	145,440	1,187,690
Sweden	2,927,945	5,962,213
United Kingdom	14,757,887	12,295,240
Other Europe	663,731	1,938,591
Canada	2,520,706	826,763
British India	.....	280,012
China	.....	571,800
Japan	839,812	5,320,498
Other countries	142,098	257,669
Old and scrap	768,222	1,711,113
Pipes and tubes	477,659	560,006
Plates and sheets	825,632	499,165
Rods	4,866,385	6,533,567
Wire	682,755	1,667,655
Insulated copper wire and cable	1,407,218	2,254,072
Lead		
In pigs, bars, and other forms:		
From domestic ore	371,909	107 007
From foreign ore	9,923,972	10,973,952
Exported to		
Belgium	672,239	.....
France	1,344,136	918,621
Germany	2,229,219	2,240,508
Italy	896,165	.....
Netherlands	448,152	1,120,286
United Kingdom	3,696,810	3,360,899
Other Europe	112,004	448,085
Brazil	336,073	11,296
Other South America	369,289	202,469
Japan	.....	2,577,311
Other countries	191,794	201,484
Other lead manufactures	732,635	2,196,157
Zinc		
Ore and concetrates, tons	12,149	5,016
Dross	3,581,327	1,858,784
Cast in slabs, blocks, or pigs	8,786,680	10,701,800
Exported to:		
Belgium	1,624,264	168,000
France	896,105	336,038
Germany	1,307,103	112,032
Italy	1,904,345	112,090
Netherlands	112,017	.....
United Kingdom	2,478,132	5,174,986
Other Europe	134,576	.....
Argentina	224,110	.....
Other countries	106,028	4,798,654
Sheets, strips, other forms	923,500	662,714
Dust	348,405	160,866
Other zinc manufactures	90,719	281,541

Mining Stocks—Week Ended November 6, 1926

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda	New York	48	47⅛	48	Oc.16, No.22 Q	0.75
Arcadian Consol.	Boston	*95	*85	*95		
Ariz. Com'l	Boston	10⅛	10	10	Jy. 16, Jy. 30	0.50
Calaveras	N. Y. Curb	...	...	1¼		
Calumet & Arizona	New York	68½	67	68	Se. 4, Se. 20 Q	1.50
Calumet & Hecla	Boston	16¼	15⅞	16¼	Au.31, Se.15	0.50
Cerro de Pasco	New York	63¼	61⅞	62¼	Jy. 15, Au.2, Q	1.00
Chile Copper	New York	32⅞	31⅝	31⅞	De.1, De.27, Q	0.62½
Chino	New York	26	25½	25½		
Con. Coppermines	N. Y. Curb	2⅞	2⅞	2⅞		
Copper Range	Boston	15	14½	14½	May, 1925	1.00
Crystal Copper	Boston Curb	*35	*31	*31		
East Butte	Boston	3	2¾	2¾	Dec., 1919	0.50
First National	Boston Curb	*6	*5	*5	Feb., 1919	0.15
Franklin	Boston	*25	*25	*25		
Granby Consol.	New York	31⅞	30⅞	31⅝	May, 1919	1.25
Greene-Cananea	New York	23⅛	20	23⅛	Nov., 1920	0.50
Hancock	Boston	...	...	*50		
Howe Sound	New York	42	41⅛	41⅞	Oc.1, Oc.15 Q	1.00
Inspiration Consl.	New York	26	25	26	Se.16, Oc.4, Q	0.50
Iron Cap	Boston Curb	3	3	3		
Isle Royale	Boston	11⅞	11⅞	11⅞	Jn. 1, Jn. 15	0.50
Jerome Verde Dev.	N. Y. Curb	48	48	48		
Kennecott	New York	62¾	61⅞	62¾	Sept. 3, Oct. 1 Q	1.00
Lake Copper	Boston	*76	*76	*76	June, 1925	0.50
Magma Copper	New York	36⅜	35⅞	36⅛	Oc.1, Oc. 15, Q	0.75
Mason Valley	N. Y. Curb	2	1¾	1¾		
Mass Consolidated	Boston	*35	*35	*35	Nov., 1917	1.00
Miami Copper	New York	16⅞	16⅝	16⅝	No.1, No. 15 Q	0.37½
Mohawk	Boston	42⅞	42¼	42⅝	Oc.30, De 1 Q	2.00
Mother Lode Coa.	New York	5⅜	5	5⅛	Jn. 15, Jn. 30	0.37½
Nevada Consol.	New York	16⅛	15⅛	16⅛	Oc.14, Nov.16	0.25
New Cornelia	Boston	23⅜	22⅝	22⅞	No.5, No.22 Q	0.50
Noranda	N. Y. Curb	19⅜	18⅞	19		
North Butte	Boston	3	3	3	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	*50	*40	*40	Se. 1, Se. 15	0.05
Old Dominion	Boston	...	...	16	Dec., 1918	1.00
Phelps Dodge	Open Mar.	†133	†129	...	Se.25, Oc.2 Q	1.50
Quincy	Boston	18½	17⅞	18⅛	Mar., 1920	1.00
Ray Consolidated	New York	16⅞	15⅝	16⅜	Ap.20, Ap.30	0.25
Ray Hercules	N. Y. Curb	...	...	11⅞		
St. Mary's Min. Ld.	Boston	26½	26⅛	26⅛	Ap.17, My.18	2.00
Seneca Copper	New York	4	3⅞	4		
Shannon	Boston	*35	*30	*35	Nov., 1917	0.25
Shattuck-Denn	Boston Curb	5⅞	5¾	5¾		
Superior & Boston	Boston	...	...	*35		
Tenn. C. & C.	New York	11⅞	11¾	11⅞	Au.31, Se.15, Q	0.25
United Verde Ex.	N. Y. Curb	25⅝	24⅞	24⅞	Oc.16, No. 1, Q	0.75
Utah Copper	New York	...	...	106⅞	Se.3, Se.17 Q	1.75
Utah Metal & T.	Boston	1⅛	1⅛	1⅛	Dec., 1917	0.30
Victoria	Boston	*45	*45	*45		
Walker Mining	Salt Lake	*73	*69	*73		
NICKEL-COPPER						
Internat. Nickel	New York	36¼	35¼	35¾	Se.7, Se.30, Q	0.50
Internat. Nickel, pfd.	New York	...	...	103	Oc.14, No.1,	1.50
LEAD						
Gladstone Mtn	Spokane	*29½	*28½	*28½	Oct., 1926	0.01
National Lead	New York	151	148	151	Sept., 1926 Q	2.00
National Lead pfd.	New York	116½	116⅜	116⅜	No.19, De.15 Q	1.75
St. Joseph Lead	New York	40⅜	39⅞	39⅞	Sept., 1926 QX	0.75
ZINC						
Am. Z. L. & S.	New York	8⅛	7⅞	8	May., 1917	1.00
Am. Z. L. & S, pfd.	New York	40½	33	40	Nov., 1920	1.50
Butte C. & Z	New York	4⅞	4⅝	4⅞	De.10, De.24	0.50
Butte & Superior	New York	13¼	12¼	12⅞	Se.15, Se.30 Q	0.50
Callahan Zn-Ld	New York	1⅞	1⅞	1⅞	Dec., 1920	0.50
Eagle-Picher	Cincinnati	30	29⅜	29⅜	Au.14, Se.1 Q	0.40
Eagle-Picher, pfd.	Cincinnati	....	....	100	Se. 30, Oc. 5 Q	1.50
New Jersey Zn.	N. Y. Curb	....	....	191	No.20, De.10 X	2.00
United Zinc	N. Y. Curb	...	...	*70		
Yellow Pine	Los Angeles	*15	*15	*15	Dec. 1925 Q	0.04
GOLD						
Alaska Juneau	New York	1	1⅞	1		
Argonaut	Toronto	*61	*56½	*59½		
Barry-Hollinger	Toronto	1	*86	*95		
Carson Hill	Boston	*20	*20	*20		
Consol. W. Dome L.	Toronto	*24½	*21	*22½		
Cresson Consol. G.	N. Y. Curb	2⅜	2⅛	2⅜	Oct., 1926	0.10
Crown Reserve	Toronto	*11	*9½	*11	Jan., 1917	0.05
Dome Mines	New York	10⅜	9⅛	9⅜	Se.20, Oc.30, Q	0.50
Golden Center	N. Y. Curb	2½	2	2		
Golden Cycle	Colo Spring	....	....	2	No.30, De.10 Q	0.04
Hollinger Consol.	Toronto	18.75	18.40	18.50	Oc.19, No.4 F	0.10
Homestake Mining	New York	....	....	62	No.20, No.26 M	0.50
Kirkland Lake	Toronto	*81	*71	*78		
Lake Shore	Toronto	14.20	13.75	14.10	No.1, De.15 Q	0.25
McIntyre-Porcupine	New York	24⅛	24⅛	24⅛	No.1, De.1 Q	0.25
Newray	Toronto	*38	*37	*37		
Night Hawk Pen.	Toronto	*5	*4	*4½		
Portland	N. Y. Curb	....	....	*43		
Rand Mines	New York	....	....	41⅞	Au.23–30 Am.Sh.	1.52
Teck-Hughes	Toronto	4.96	4.77	4.86	Jy. 15, Au. 2	0.05
Tom Reed	Los Angeles	....	....	*44	March, 1926	0.02
Tough-Oakes	Toronto	*56	*47½	*55		
United Eastern	N. Y. Curb	....	....	*45	July, 1924	0.05
Vipond Cons.	Toronto	1.70	1.66	1.66		
Wright-Hargreaves	Toronto	8.60	8.05	8.10	Se.15, Oc.1 QX	0.07½
Yukon-Alaska Trust	N. Y. Curb	....	....	20		
GOLD AND SILVER						
Carnegie Metals	Boston	....	....	12		
Con. Cortez	N. Y. Curb	....	....	*5		
Con. Virginia	San Francisco	*7½	*7½	*7½		
Continental Mines	N. Y. Curb	...	...	*48		
Dolores Esperanza	N. Y. Curb	*45	*45	*45	July, 1923	0.05
Premier Gold	N. Y. Curb	2⅛	1⅞	1⅞	Se.15, Oc.4 Q	0.08
Tonopah Belmont	N. Y. Curb	2⅝	2½	2⅝	Se.15, Oc.1	0.05
Tonopah Extension	N. Y. Curb	*34	*28	*34	Apr. 1925	0.05
Tonopah Mining	N. Y. Curb	3⅜	3⅛	3⅜	Se.30, Oc.27 SA	0.07½
Unity Gold	N. Y. Curb	....	....	*30		
West End Consol.	N. Y. Curb	....	....	*16	Mar., 1923	0.05
Yukon Gold	N. Y. Curb	....	....	*30	June, 1918	0.02

Stock	Exch.	High	Low	Last		Last Div.
SILVER						
Alvarado	N. Y. Curb	....	....	1	Oct., 1920	0.50
Beaver Consol	Toronto	*63	*56	*60	May. 1920	0.03
Castle-Trethewey	Toronto	1.10	1.04	1.04		
Comagas	Toronto	4.30	4.15	4.30	May, 1924	0.12½
Keeley	Toronto	1.55	1.48	1.55	Se. 1, Se.15 SA	0.12
Kerr Lake	N. Y. Curb	*85	*71	*71	Oc. 1, Oc.15 SA	0.12½
La Rose	Toronto	*7	*7	*7	Apr., 1922	0.10½
Lorrain Trout Lake	Toronto	....	....	*35	Jy. 2, Jy. 15	0.05
McKinley-Dar.-Sav	Toronto	*9½	*9	*9½	Oct., 1920	0.03
Mining Corp. Can.	Toronto	2.80	2.65	2.66	Jy.1, Jy.15 SA	0.12½
Nipissing	N. Y. Curb	6¼	5⅜	5⅜	Se.30, Oc.20 Q	0.15
Temiskaming	Toronto	*8	*8	*8	Jan., 1920	0.40
SILVER-LEAD						
Ahumada	New York	6¾	6¾	6⅝	Se.28, Oc.1, QX	0.25
Alta Merger	Salt Lake	†*4	†*2	...		
Bingham Mines	Boston	35	35	35	Se.20, Se.30 Q	1.00
Cardiff M. & M.	Salt Lake	*20	*20	*20	Nov., 1924	0.10
Chief Consol.	Salt Lake	2.60	2.60	2.60	De.15, Ja.2 Q	0.75
Consti'n Mng. & Mill'g	Spokane	*58	*51	*51		
Emma Silver	Salt Lake	†1	†*50	...		
Erupcion	Boston Curb	1⅞	1¼	1¼	Se.25, Oc.1, QX	0.10
Federal M. & S.	New York	90	80	90		
Federal M. & S., pfd.	New York	75⅞	72	75¼	Au.25, Se.15 Q	1.75
Hawthorne Mines	N. Y. Curb	*10	*8	*9		
Hecla Mining	N. Y. Curb	17	16⅞	16⅞	Au.14, Se.15 Q	0.50
Highland-Surprise	Spokane	*23½	*21	*23½		
Iron King Mining	Salt Lake	*18	*15	*15		
Keystone Mining	Salt Lake	....	....	*26	Au.12, Au.26	0.07½
Lucky Jim	Spokane	*15½	*15⅜	*15⅜		
Lucky-Tiger Com.	Kansas City	†7.35	†7.00	....	Nov. 20, 1926	0.10
Mammoth Mining	Salt Lake	2.55	2.55	2.55	Mar.24, Apr. 1	0.10
Marsh Mines	Spokane	3⅛	3⅛	3⅛	Se.15, Oc.19	0.15
Park Utah	New York	6.00	5.70	6.00	Se.15, Oc 1 Q	0.15
Plutus Mining	Salt Lake	1.90	1.87½	1.87½	Oct. 15, Q	0.15
Prince Cons.	Salt Lake	2¼	2⅜	2¼		
Silver King Coal	Salt Lake	7.50	7.40	7.50	Se. 20, Oc.1, Q	0.25
Silversmith	Spokane	*39½	*38½	*38½	Oc.1, Oc.10 Q	0.02
Strattons Mines	Spokane	*43	*40	*40		
Tamarack-Custer	Spokane	*33¼	*29	*33½	Sept., 1924	0.25
Tintic Standard	Salt Lake	11.00	11.00	11.00	Se.13, Se.25 QX	0.40
Utah-Apex	Boston	5	4⅜	5	Oc.3, Oc.15 Q	0.25
Western Utah Copper	N. Y. Curb	....	....	*5		
IRON						
Bethlehem Steel	New York	45⅜	44	45	July, 1924	1.25
Cleveland-Cliffs Iron	Cleveland	†80	†78	...	Oct., 1926	1.00
Colorado Fuel & Iron	New York	41⅞	39½	40⅜	May, 1921	0.75
Gt. North'n Iron Ore	New York	21¼	19	21	Dec., 1925	0.75
Inland Steel	New York	41	38⅝	41	No.15, De.1 Q	0.62½
Mesabi Iron	N. Y. Curb	1¼	1¼	1¼		
Replogle Steel	New York	9⅝	8⅞	9⅛		
Republic I. & S.	New York	56⅜	55½	56	No.15, De.1 Q	1.00
Republic I. & S. pfd.	New York	95¾	95½	95⅜	De.15, Ja.2 Q	1.75
Sloss-Sheffield S. & I.	New York	121	120	121	Se.10, Se.20 Q	1.50
Sloss-Shef. S.&I. pfd.	New York	106	105½	106	Se.20, Oc.1 Q	1.75
U. S. Steel	New York	145¼	138	144⅛	De.1, De.30 Q	1.75
U. S. Steel pfd	New York	128	127½	128	No.2, No.29, Q	1.75
Virginia I. C. & C.	New York	50⅛	48	50⅛	Jan., 1924	1.50
Virginia I.C.&C.pfd	New York	....	....	72	Jn.1, July 2, SA	2.50
DIAMONDS, PLATINUM, ALUMINUM, VANADIUM						
De Beers Consol	New York	36⅜	36⅛	36⅛	Ju.16, Ju.17	1.70
So. Am. Gold & P.	N. Y. Curb	4⅛	3⅞	4⅛		
Alum. Co. of Amer.	N.Y. Curb	68⅛	68⅛	68⅛		
Alum. Co. of Amer pf.	N.Y. Curb	102	102	102	Oct. 1, Q,	1.50
Vanadium Corp.	New York	40⅞	39½	39½	De.1, De.15, X	1.00
ASBESTOS						
Asbestos Corp., New	Montreal	25	24¼	24½	Jan., 1926	1.50
Asbestos Corp., pfd.	Montreal	81⅛	81	81⅛	Jy.1, Jy.15, SA	1.75
SULPHUR						
Freeport Texas	New York	32¼	29⅞	30⅞	Nov., 1919	1.00
Texas Gulf, new	New York	47⅛	43⅛	47	Se.7, Se. 15, Q	3.00
MINING, SMELTING, REFINING AND GENERAL						
Amer. Metal	New York	46½	45	46¼	No.19, De. 1, Q	1.00
Amer. Metal pfd	New York	....	....	114	No.20, De.1 Q	1.75
Amer. Sm. & Ref.	New York	134⅝	128½	134½	Oc.15, No.1, Q	2.00
Amer. Sm.&Ref.pfd.	New York	119	117½	118½	No.5, De.1, Q	1.75
Consol. M. & S.	N. Y. Curb	...	...	300	Jn.30, Jy.5	BAX 3.75
Federated Metals	N. Y. Curb	12½	12	12		
Newmont Mining	N. Y. Curb	76½	73	76¼	Oc.1, Oc.15, Q	0.60
Southwest Metals	N. Y. Curb	...	...	1		
U. S. Sm. R. & M.	New York	31¼	30⅜	30⅜	Oc.7, Oc.15, Q	0.87½
U. S. Sm. R.&M.pfd.	New York	43⅞	43½	43½	Oc.7, Oc.15, Q	0.87½

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. F, four weeks. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Henry Sachs, Colorado Springs, Colo.

PRICE WEEK ENDED OCT. 26, 1926

Name	High	Low	Last	Last Divd. Date	Amount
Aramayo Mines (25 frs.)	78/9	76/—	78/9	Nov. 1926	5 p.c.†
British Platinum (£1)	4/6	3/6	4/—	Feb. 1925	2½ p.c.
Burma Corpn. (10 rupees)	15/1½	14/7½	14/10½	Aug. 1926	7 annas*
Bwana M'Kubwa (5s)	7/9	7/3	7/4½		
Camp Bird (2s)	3/9	2/6	2/9		
El Ore (£1)	5/9	5/1½	5/9	Nov. 1924	2½ p.c.*
Esperansa (10s)	—/7½	—/7	—/7		
Frontino & Bolivia (£1)	8/9	8/6	8/9	July 1926	2½ p.c.
Mexican Corpn. (£1)	11/4½	10/—	11/—		
Mexico Mines of El Oro (£1)	21/3	17/6	21/3	June 1926	7½ p.c.*
Oroville Dredging (£1)	3/—	2/6	3/—	Dec. 1923	3¾ p.c.
Ouro Preto (£1)	2/3	1/10½	2/—	May 1925	2½ p.c.
Rhodesian Congo Border (£1)	112/6	107/6	107/6		
St. John del Rey (£1)	9/—	8/4½	8/9	June 1925	6½ p.c.
San Francisco Mines (10s)	33/3	31/1½	33/—	June 1926	15 p.c.
Santa Gertrudis (£1)	14 4½	13/—	14/—	Oct. 1926	3½ p.c.
Selukwe (2s. 6d.)	13/—	12/4½	12/6	April 1917	6¾ p.c.
S. Amer. Copper (2s.)	4 4½	3/10½	4/—	Nov. 1917	75 p.c.
Tanganyika (£1)	47 9	42/6	46/3	Aug. 1926	7½ p.c.
Tomboy (£1)	3/9	3/4½	3/9	July 1926	10 p.c.
Union Miniere du Haut-Katanga (Brussels)	9.500	8.850	9.000	July 1926	175 (‡)

* Free of British income tax. † Swiss frs. ‡ Belgian frs. and free of taxation.